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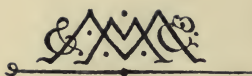
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# FOUR FIGURE MATHEMATICAL TABLES:

COMPRISING LOGARITHMIC AND TRIGONOMETRICAL TABLES, AND  
TABLES OF SQUARES, SQUARE ROOTS, AND RECIPROCAL.

BY

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# EXPLANATIONS AND RULES

FOR THE

USE OF THE ACCOMPANYING TABLES.

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THE logarithm of a number consists in general of two parts, an integer part and a decimal. The integer part is called the *Index* or *Characteristic*; the decimal part is called the *Mantissa*.

**RULE I.** The *Index* of the logarithm of a number greater than unity is the number which is less by one than the number of digits in the integral part of the given number.

Thus, the index of the logarithm of   47320   is 4.  
  473'2   is 2.  
  4'732 is 0.

**RULE II.** The *Index* of the logarithm of a number less than unity, and reduced to the form of a decimal fraction, is negative, and is a higher number by one than the number of zeros that follow the decimal point of the given number.

Thus, the index of the logarithm of   .4732   is - 1  
  .004732 is - 3

To denote that the index is negative the sign minus is often written above it; thus  $\bar{1}$ ,  $\bar{3}$ .

**RULE III.** To find the mantissa of the logarithm of a given number consisting of four figures.—Find the *first two* figures in the left hand column of the table. Pass along the corresponding horizontal line and take the number in the vertical column headed by the *third* figure. To this number *add* the number found in the difference columns under the *fourth* figure of the given number. The sum with a decimal point prefixed is the required *mantissa*.

*Example.* Find the mantissas corresponding to the sequences of figures 4732 and 6985.

|     |   |      |      |      |   |       |
|-----|---|------|------|------|---|-------|
| 473 | - | -    | -    | -    | - | 6749  |
|     | 2 | from | dif. | col. | - | 2     |
|     |   |      |      |      |   | <hr/> |
|     |   |      |      |      |   | ·6751 |
| 698 | - | -    | -    | -    | - | 8439  |
|     | 5 | from | dif. | col. | - | 3     |
|     |   |      |      |      |   | <hr/> |
|     |   |      |      |      |   | ·8442 |

**RULE IV.** To find the logarithm of a given number consisting of four figures.—Find the mantissa corresponding to the given four figures, and to it prefix the proper index. The number thus obtained is the required logarithm.

*Examples.*

|              |   |   |   |    |        |
|--------------|---|---|---|----|--------|
| log 47320    | - | - | - | is | 4·6751 |
| log 47·32    | - | - | - | is | 1·6751 |
| log 6·985    | - | - | - | is | 0·8442 |
| log 0·006985 | - | - | - | is | 3·8442 |

*Note.*—A logarithm whose index is negative really consists of a positive mantissa with a negative index algebraically added to it. Thus:— $1·8442 = +0·8442 - 1$ . It is important to bear this in mind in numerical operations on logarithms. For example, in taking the square root of 0·6985, the logarithm of that number is divided by 2, and in taking the cube by 3. The simplest way of doing this is as follows:—

$$\frac{1}{2}(\cdot 8442 - 1) = \frac{1}{2}(1 \cdot 8442 - 2) = \cdot 9221 - 1$$

$$\frac{1}{3}(\cdot 8442 - 1) = \frac{1}{3}(2 \cdot 8442 - 3) = \cdot 9481 - 1$$

**RULE V.** To find the anti-logarithm of a given logarithm, *i.e.*, the number corresponding to the given logarithm.—Find in the table of anti-logarithms, proceeding as in Rule III., the sequence of figures corresponding to the *mantissa* of the given logarithm. To these figures place a decimal point, in the position indicated by the index of the given logarithm, prefixing or affixing zeros, if necessary. (See Rules I and II.) The number thus obtained is that required.

*Examples.* Given the logarithm 2·7834 find the anti-logarithm.

|     |   |      |      |      |   |       |
|-----|---|------|------|------|---|-------|
| 783 | - | -    | -    | -    | - | 6067  |
|     | 4 | from | dif. | col. | - | 6     |
|     |   |      |      |      |   | <hr/> |
|     |   |      |      |      |   | 6073  |

Hence the number whose logarithm is 2·7834 is 607·3.

The number corresponding to the logarithm 6.7834 is 6073000; that corresponding to 7.7834 is .0006073.

*Note.*—The use of Rules I. and II., which are commonly given for the purposes of finding the index and of placing the decimal point in an anti-logarithm, may be dispensed with altogether if the principle on which these rules are founded is kept in view; and in reality the principle is more simple than the rules and easier to remember. The logarithm, to the base 10, of any number greater than 1 and less than 10 is a positive proper fraction, and is given in the tables as a decimal without whole number. On the other hand the anti-logarithm of a decimal without whole number is a number greater than 1 and less than 10.

Thus  $\log 7.32 = 0.8645$ ; and the logarithm 0.6931 corresponds to the number 4.933.

Any number such as 7320, or .000732 is derived from 7.32 by multiplying or dividing by a power of 10; and the corresponding change in the logarithm is made by adding or subtracting the index of that power of 10.

$$\begin{aligned}\text{Thus} \quad 7320 &= 7.32 \times 10^3; \quad \log. 7320 = .8645 + 3 \\ .000732 &= 7.32 \times 10^{-4}; \quad \log. .000732 = .8645 - 4\end{aligned}$$

In the same way since .6931 as a logarithm corresponds to 4.933, it follows that 2.6931, or .6931 + 2, corresponds to  $4.933 \times 10^2$ ; and 3.6931, or .6931 - 3, corresponds to  $4.933 \times 10^{-3}$ .

**RULE VI.** Given any angle less than  $90^\circ$  to find its natural sine, cosine, tangent, etc., or its value in radian measure.\*—Find the degrees in the left hand column of the proper table. Pass along the corresponding horizontal line, and take out the number in the vertical column headed by the number of minutes lower than, and nearest to, the given number of minutes. Take the difference between the number of minutes given and the number of minutes just found, and from the difference columns find in the same horizontal line the corresponding correction. This correction is *additive* in the cases of the sine, tangent, secant, and radian measure. In the cases of cosine, cotangent, and cosecant it is *subtractive*.

*Note.*—It will be observed that the main division of the degree in the trigonometrical tables is into parts of 6' each. This corresponds to *decimals* of the degree. Thus,  $12^\circ 18' = 12.3^\circ$ .

*Note.*—In the tables of natural sines and cosines the decimal points are omitted. In the other tables the decimal points and the whole numbers which precede them are omitted in all the columns except

\* Formerly called "circular measure."

that headed  $0'$ ; and excepting also the case of a few numbers at the extremities of the tables, where the variation of the trigonometrical function is extremely rapid. At the extremities of some of the tables differences are not given, as the variation of the function is so rapid as to make the differences unserviceable.

*Examples.* Find the sine and cosine of  $18^{\circ}27'$ , and the tangent and secant of  $58^{\circ}44'$ .

|                        |                      |   |   |   |        |
|------------------------|----------------------|---|---|---|--------|
| From table of sines    | $18^{\circ}24'$      | . | . | . | '3156  |
|                        | $3'$                 | . | . | . | 8      |
|                        | <hr/>                |   |   |   |        |
|                        | $\sin 18^{\circ}27'$ | . | . | . | '3164  |
| From table of cosines  | $18^{\circ}24'$      | . | . | . | '9489  |
|                        | $3'$                 | . | . | . | 3      |
|                        | <hr/>                |   |   |   |        |
|                        | $\cos 18^{\circ}27'$ | . | . | . | '9486  |
| From table of tangents | $58^{\circ}42'$      | . | . | . | 1'6447 |
|                        | $2'$                 | . | . | . | 21     |
|                        | <hr/>                |   |   |   |        |
|                        | $\tan 58^{\circ}44'$ | . | . | . | 1'6468 |
| From table of secants  | $58^{\circ}42'$      | . | . | . | 1'9249 |
|                        | $2'$                 | . | . | . | 18     |
|                        | <hr/>                |   |   |   |        |
|                        | $\sec 58^{\circ}44'$ | . | . | . | 1'9267 |

**RULE VII.** To find the logarithmic sine, tangent, cosine, cotangent, secant, or cosecant of an angle less than  $90^{\circ}$ . Proceed as in Rule VI., using the proper table.

*Note.*—The sines of all angles, and the tangents of angles less than  $45^{\circ}$ , being less than unity, the logarithms of these sines and tangents are preceded by a negative index. In order to avoid the writing of these negative indices the number 10 is added to the *real* value of the log. sin. log. tan. etc., and the number so found is entered in the tables. In all calculations this must be borne in mind, and allowance must be made.

**RULE VIII.** To find the angle in degrees and minutes, or in degrees and decimals of a degree, corresponding to any given natural or logarithmic sine, cosine, tangent, etc. Find in the proper table the number nearest to that given, interpolating, if necessary, by means of the difference columns; and by reversing the process of Rules VI. and VII. obtain the corresponding number of degrees and minutes, or degrees and decimals of a degree.

The preceding explanations are easily applicable to the remaining

tables of squares, square roots, and reciprocals. With regard to the tables of squares and square roots, it is to be noticed that while the square of such a number as 528 is found from the square of 5'28 simply by multiplying by a power of 10, a similar relation does *not* hold always in the case of the square root. It is necessary, therefore, to have two tables of square roots—one extending from 1 or 100 to 9.99 or 999, and the other from 10 or 1000 to 99.99 or 9999.\*

**RULE IX.** To find the Neperian or hyperbolic logarithm of a number.—If the number be greater than 1 and less than 10 its Neperian logarithm is found directly from the proper table in the manner explained in Rule III. If the number is greater than 10 or less than 1, it may always be expressed as the product of two factors, of which one is a power of 10, and the other a number greater than 1 and less than 10; the latter being simply the original series of figures with the decimal point suitably moved. The sum of the Neperian logarithms of these two factors is the Neperian logarithm of the given number. A table of Neperian logarithms of powers of 10 is given on pp. 54, 55-*Examples.*

Find the Neperian logarithms of 3'241, 324'I, and '0003241.

$$(1) \quad \log_e 3'241 \quad - \quad - \quad \text{is } 1'1759$$

$$(2) \quad \log_e 324'I = \log_e 3'241 \times 10^2$$

$$\log_e 3'241 \quad - \quad - \quad 1'1759$$

$$\log_e 10^2 \quad - \quad - \quad 4'6052$$

---


$$\log_e 324'I \quad - \quad - \quad 5'7811$$

$$(3) \quad \log_e '0003241 = \log_e 3'241 \times 10^{-4}$$

$$\log_e 3'241 \quad - \quad - \quad 1'1759$$

$$\log_e 10^{-4} \quad - \quad - \quad \overline{10'7897}$$

---


$$\log_e '0003241 \quad - \quad - \quad \overline{9'9656}$$

In calculating the value of a fraction, of which the numerator and denominator each consists of two or more factors, it is often of advantage, instead of *subtracting* the logarithms of the denominator factors, to add in the logarithms of their reciprocals—the complemental logarithms or co-logs as they are sometimes called.

\* That which causes the necessity for two such tables gives rise also to the necessity for watchfulness on the part of the calculator. Probably the best preventive against mistakes is the habit, excellent in all calculations, of making a mental estimate of the number to be expected as the result of taking the square root. Mistakes may also be avoided easily and with little loss of time by comparing with the table of squares.



**RULE X.** To find the mantissa of the logarithm of a reciprocal.—Write down the difference between the mantissa of the logarithm of the given number and 10000; or simply, commencing at the left hand, write down the series of numbers which will make each figure of the mantissa of the logarithm of the number up to be equal to 9, except the last significant figure, which must be made up to 10.

**RULE XI.** Otherwise : To find the mantissa of the logarithm of a reciprocal.—Proceed as in Rule III., using the Table of Logarithms of Reciprocals.

**RULE XII.** To find the index for the logarithm of a reciprocal.—If the given number consist of a whole number and a decimal, the index is equal to the number of the digits which constitute the whole number, and is *negative*. If the given number is a decimal without a whole number the index is equal to the number of zeros which follow the decimal point and is *positive*.

*Examples.* Find

$$\log \frac{I}{237.4}$$

Mantissa of co-log from table, p. 16.      -      -      .6246.

Index - - - - - - - - -3

$$\log \frac{1}{237.4} = .6246 - 3 \text{ or } \bar{3}.6246$$

$$\log \frac{1}{\cdot 002374} = \cdot 6246 + 2 \text{ or } 2\cdot 6246$$

*Remark.*—In finding the logarithm of the reciprocal of a trigonometrical function it is only necessary to subtract the *tabular logarithm* from 10. This will readily be seen from an example.

Since (see *Note* to Rule VII.),

$$\log \sin 36^\circ = \text{Tab. } \log \sin 36^\circ - 10$$

we have

$$\log \left( \frac{I}{\sin 36^\circ} \right) = -\log \sin 36^\circ = 10 - \text{Tab. log } \sin 36^\circ.$$

The subtraction from 10 is most easily performed by writing down the numbers which make up the figures of the tabular logarithm to 9, as in Rule X., except in the case of the last significant figure, for which write the number which, if added to it, would make it up to be 10.

An example of calculation is given here in order to show a convenient way of writing down the given numbers and their logarithms. It is scarcely possible to overestimate the importance of strict adherence to method; for instance, in physical calculations. In the

first place errors are thus most easily avoided or detected ; and it is also frequently useful to be able to return on the arithmetical steps in order to make an alteration of form, or, if improved data are forthcoming, to obtain a result true to a closer degree of approximation.

*Example.* Calculate the value of

$$\frac{27.34 \times 0.1325 \times \sin 29^\circ}{14.23 \times .00176 \times \tan 34^\circ}$$

| Numbers.                  |           | Logs.                 |
|---------------------------|-----------|-----------------------|
| 27.34                     | - - - - - | .4368 + 1             |
| 0.1325 (see table, p. 12) | -         | .1222 - 1             |
| $\sin 29^\circ$           | - - - - - | 9.6856 - 10           |
| $1/14.23$                 | - - - - - | .8468 - 2             |
| $1/.00176$                | - - - - - | .7545 + 2             |
| $1/\tan 34^\circ$         | - - - - - | 0.1710 + 0            |
|                           |           | <hr/>                 |
|                           |           | .0169 + 2             |
| Result                    | - -       | $1.040 \times 10^2$ . |

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J. T. B.

February 18, 1890.

|     | 0    | 1    | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    |
|-----|------|------|------|------|------|------|------|------|------|------|
| 100 | 0000 | 0004 | 0009 | 0013 | 0017 | 0022 | 0026 | 0030 | 0035 | 0039 |
| 101 | 0043 | 0048 | 0052 | 0056 | 0060 | 0065 | 0069 | 0073 | 0077 | 0082 |
| 102 | 0086 | 0090 | 0095 | 0099 | 0103 | 0107 | 0111 | 0116 | 0120 | 0124 |
| 103 | 0128 | 0133 | 0137 | 0141 | 0145 | 0149 | 0154 | 0158 | 0162 | 0166 |
| 104 | 0170 | 0175 | 0179 | 0183 | 0187 | 0191 | 0195 | 0199 | 0204 | 0208 |
| 105 | 0212 | 0216 | 0220 | 0224 | 0228 | 0233 | 0237 | 0241 | 0245 | 0249 |
| 106 | 0253 | 0257 | 0261 | 0265 | 0269 | 0273 | 0278 | 0282 | 0286 | 0290 |
| 107 | 0294 | 0298 | 0302 | 0306 | 0310 | 0314 | 0318 | 0322 | 0326 | 0330 |
| 108 | 0334 | 0338 | 0342 | 0346 | 0350 | 0354 | 0358 | 0362 | 0366 | 0370 |
| 109 | 0374 | 0378 | 0382 | 0386 | 0390 | 0394 | 0398 | 0402 | 0406 | 0410 |
| 110 | 0414 | 0418 | 0422 | 0426 | 0430 | 0434 | 0438 | 0441 | 0445 | 0449 |
| 111 | 0453 | 0457 | 0461 | 0465 | 0469 | 0473 | 0477 | 0481 | 0484 | 0488 |
| 112 | 0492 | 0496 | 0500 | 0504 | 0508 | 0512 | 0515 | 0519 | 0523 | 0527 |
| 113 | 0531 | 0535 | 0538 | 0542 | 0546 | 0550 | 0554 | 0558 | 0561 | 0565 |
| 114 | 0569 | 0573 | 0577 | 0580 | 0584 | 0588 | 0592 | 0596 | 0599 | 0603 |
| 115 | 0607 | 0611 | 0615 | 0618 | 0622 | 0626 | 0630 | 0633 | 0637 | 0641 |
| 116 | 0645 | 0648 | 0652 | 0656 | 0660 | 0663 | 0667 | 0671 | 0674 | 0678 |
| 117 | 0682 | 0686 | 0689 | 0693 | 0697 | 0700 | 0704 | 0708 | 0711 | 0715 |
| 118 | 0719 | 0722 | 0726 | 0730 | 0734 | 0737 | 0741 | 0745 | 0748 | 0752 |
| 119 | 0755 | 0759 | 0763 | 0766 | 0770 | 0774 | 0777 | 0781 | 0785 | 0788 |
| 120 | 0792 | 0795 | 0799 | 0803 | 0806 | 0810 | 0813 | 0817 | 0821 | 0824 |
| 121 | 0828 | 0831 | 0835 | 0839 | 0842 | 0846 | 0849 | 0853 | 0856 | 0860 |
| 122 | 0864 | 0867 | 0871 | 0874 | 0878 | 0881 | 0885 | 0888 | 0892 | 0896 |
| 123 | 0899 | 0903 | 0906 | 0910 | 0913 | 0917 | 0920 | 0924 | 0927 | 0931 |
| 124 | 0934 | 0938 | 0941 | 0945 | 0948 | 0952 | 0955 | 0959 | 0962 | 0966 |
| 125 | 0969 | 0973 | 0976 | 0980 | 0983 | 0986 | 0990 | 0993 | 0997 | 1000 |
| 126 | 1004 | 1007 | 1011 | 1014 | 1017 | 1021 | 1024 | 1028 | 1031 | 1035 |
| 127 | 1038 | 1041 | 1045 | 1048 | 1052 | 1055 | 1059 | 1062 | 1065 | 1069 |
| 128 | 1072 | 1075 | 1079 | 1082 | 1086 | 1089 | 1092 | 1096 | 1099 | 1103 |
| 129 | 1106 | 1109 | 1113 | 1116 | 1119 | 1123 | 1126 | 1129 | 1133 | 1136 |
| 130 | 1139 | 1143 | 1146 | 1149 | 1153 | 1156 | 1159 | 1163 | 1166 | 1169 |
| 131 | 1173 | 1176 | 1179 | 1183 | 1186 | 1189 | 1193 | 1196 | 1199 | 1202 |
| 132 | 1206 | 1209 | 1212 | 1216 | 1219 | 1222 | 1225 | 1229 | 1232 | 1235 |
| 133 | 1239 | 1242 | 1245 | 1248 | 1252 | 1255 | 1258 | 1261 | 1265 | 1268 |
| 134 | 1271 | 1274 | 1278 | 1281 | 1284 | 1287 | 1290 | 1294 | 1297 | 1300 |
| 135 | 1303 | 1307 | 1310 | 1313 | 1316 | 1319 | 1323 | 1326 | 1329 | 1332 |
| 136 | 1335 | 1339 | 1342 | 1345 | 1348 | 1351 | 1355 | 1358 | 1361 | 1364 |
| 137 | 1367 | 1370 | 1374 | 1377 | 1380 | 1383 | 1386 | 1389 | 1392 | 1396 |
| 138 | 1399 | 1402 | 1405 | 1408 | 1411 | 1414 | 1418 | 1421 | 1424 | 1427 |
| 139 | 1430 | 1433 | 1436 | 1440 | 1443 | 1446 | 1449 | 1452 | 1455 | 1458 |
| 140 | 1461 | 1464 | 1467 | 1471 | 1474 | 1477 | 1480 | 1483 | 1486 | 1489 |



# LOGARITHMS OF RECIPROCAL 1000 TO 1409.

13

LOGARITHMS OF RECIPROCAL.

|     | 0    | 1    | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    |
|-----|------|------|------|------|------|------|------|------|------|------|
| 100 |      | 9996 | 9991 | 9987 | 9983 | 9978 | 9974 | 9970 | 9965 | 9961 |
| 101 | 9957 | 9952 | 9948 | 9944 | 9940 | 9935 | 9931 | 9927 | 9923 | 9918 |
| 102 | 9914 | 9910 | 9905 | 9901 | 9897 | 9893 | 9889 | 9884 | 9880 | 9876 |
| 103 | 9872 | 9867 | 9863 | 9859 | 9855 | 9851 | 9846 | 9842 | 9838 | 9834 |
| 104 | 9830 | 9825 | 9821 | 9817 | 9813 | 9809 | 9805 | 9801 | 9796 | 9792 |
| 105 | 9788 | 9784 | 9780 | 9776 | 9772 | 9767 | 9763 | 9759 | 9755 | 9751 |
| 106 | 9747 | 9743 | 9739 | 9735 | 9731 | 9727 | 9722 | 9718 | 9714 | 9710 |
| 107 | 9706 | 9702 | 9698 | 9694 | 9690 | 9686 | 9682 | 9678 | 9674 | 9670 |
| 108 | 9666 | 9662 | 9658 | 9654 | 9650 | 9646 | 9642 | 9638 | 9634 | 9630 |
| 109 | 9626 | 9622 | 9618 | 9614 | 9610 | 9606 | 9602 | 9598 | 9594 | 9590 |
| 110 | 9586 | 9582 | 9578 | 9574 | 9570 | 9566 | 9562 | 9559 | 9555 | 9551 |
| 111 | 9547 | 9543 | 9539 | 9535 | 9531 | 9527 | 9523 | 9519 | 9516 | 9512 |
| 112 | 9508 | 9504 | 9500 | 9496 | 9492 | 9488 | 9485 | 9481 | 9477 | 9473 |
| 113 | 9469 | 9465 | 9462 | 9458 | 9454 | 9450 | 9446 | 9442 | 9439 | 9435 |
| 114 | 9431 | 9427 | 9423 | 9420 | 9416 | 9412 | 9408 | 9404 | 9401 | 9397 |
| 115 | 9393 | 9389 | 9385 | 9382 | 9378 | 9374 | 9370 | 9367 | 9363 | 9359 |
| 116 | 9355 | 9352 | 9348 | 9344 | 9340 | 9337 | 9333 | 9329 | 9326 | 9322 |
| 117 | 9318 | 9314 | 9311 | 9307 | 9303 | 9300 | 9296 | 9292 | 9289 | 9285 |
| 118 | 9281 | 9278 | 9274 | 9270 | 9266 | 9263 | 9259 | 9255 | 9252 | 9248 |
| 119 | 9245 | 9241 | 9237 | 9234 | 9230 | 9226 | 9223 | 9219 | 9215 | 9212 |
| 120 | 9208 | 9205 | 9201 | 9197 | 9194 | 9190 | 9187 | 9183 | 9179 | 9176 |
| 121 | 9172 | 9169 | 9165 | 9161 | 9158 | 9154 | 9151 | 9147 | 9144 | 9140 |
| 122 | 9136 | 9133 | 9129 | 9126 | 9122 | 9119 | 9115 | 9112 | 9108 | 9104 |
| 123 | 9101 | 9097 | 9094 | 9090 | 9087 | 9083 | 9080 | 9076 | 9073 | 9069 |
| 124 | 9066 | 9062 | 9059 | 9055 | 9052 | 9048 | 9045 | 9041 | 9038 | 9034 |
| 125 | 9031 | 9027 | 9024 | 9020 | 9017 | 9014 | 9010 | 9007 | 9003 | 9000 |
| 126 | 8996 | 8993 | 8989 | 8986 | 8983 | 8979 | 8976 | 8972 | 8969 | 8965 |
| 127 | 8962 | 8959 | 8955 | 8952 | 8948 | 8945 | 8941 | 8938 | 8935 | 8931 |
| 128 | 8928 | 8925 | 8921 | 8918 | 8914 | 8911 | 8908 | 8904 | 8901 | 8897 |
| 129 | 8894 | 8891 | 8887 | 8884 | 8881 | 8877 | 8874 | 8871 | 8867 | 8864 |
| 130 | 8861 | 8857 | 8854 | 8851 | 8847 | 8844 | 8841 | 8837 | 8834 | 8831 |
| 131 | 8827 | 8824 | 8821 | 8817 | 8814 | 8811 | 8807 | 8804 | 8801 | 8798 |
| 132 | 8794 | 8791 | 8788 | 8784 | 8781 | 8778 | 8775 | 8771 | 8768 | 8765 |
| 133 | 8761 | 8758 | 8755 | 8752 | 8748 | 8745 | 8742 | 8739 | 8735 | 8732 |
| 134 | 8729 | 8726 | 8722 | 8719 | 8716 | 8713 | 8710 | 8706 | 8703 | 8700 |
| 135 | 8697 | 8693 | 8690 | 8687 | 8684 | 8681 | 8677 | 8674 | 8671 | 8668 |
| 136 | 8665 | 8661 | 8658 | 8655 | 8652 | 8649 | 8645 | 8642 | 8639 | 8636 |
| 137 | 8633 | 8630 | 8626 | 8623 | 8620 | 8617 | 8614 | 8611 | 8608 | 8604 |
| 138 | 8601 | 8598 | 8595 | 8592 | 8589 | 8586 | 8582 | 8579 | 8576 | 8573 |
| 139 | 8570 | 8567 | 8564 | 8560 | 8557 | 8554 | 8551 | 8548 | 8545 | 8542 |
| 140 | 8539 | 8536 | 8533 | 8529 | 8526 | 8523 | 8520 | 8517 | 8514 | 8511 |

$$\log E = 0.4343$$

|    | 0    | 1    | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 12 | 3 | 4  | 5  | 6  | 7  | 8  | 9  |    |
|----|------|------|------|------|------|------|------|------|------|------|----|---|----|----|----|----|----|----|----|
| 10 | 0000 | 0043 | 0086 | 0128 | 0170 | 0212 | 0253 | 0294 | 0334 | 0374 | 4  | 8 | 12 | 17 | 21 | 25 | 29 | 33 | 37 |
| 11 | 0414 | 0453 | 0492 | 0531 | 0569 | 0607 | 0645 | 0682 | 0719 | 0755 | 4  | 8 | 11 | 15 | 19 | 23 | 26 | 30 | 34 |
| 12 | 0792 | 0828 | 0864 | 0899 | 0934 | 0969 | 1004 | 1038 | 1072 | 1106 | 3  | 7 | 10 | 14 | 17 | 21 | 24 | 28 | 31 |
| 13 | 1139 | 1173 | 1206 | 1239 | 1271 | 1303 | 1335 | 1367 | 1399 | 1430 | 3  | 6 | 10 | 13 | 16 | 19 | 23 | 26 | 29 |
| 14 | 1461 | 1492 | 1523 | 1553 | 1584 | 1614 | 1644 | 1673 | 1703 | 1732 | 3  | 6 | 9  | 12 | 15 | 18 | 21 | 24 | 27 |
| 15 | 1761 | 1790 | 1818 | 1847 | 1875 | 1903 | 1931 | 1959 | 1987 | 2014 | 3  | 6 | 8  | 11 | 14 | 17 | 20 | 22 | 25 |
| 16 | 2041 | 2068 | 2095 | 2122 | 2148 | 2175 | 2201 | 2227 | 2253 | 2279 | 3  | 5 | 8  | 11 | 13 | 16 | 18 | 21 | 24 |
| 17 | 2304 | 2330 | 2355 | 2380 | 2405 | 2430 | 2455 | 2480 | 2504 | 2529 | 2  | 5 | 7  | 10 | 12 | 15 | 17 | 20 | 22 |
| 18 | 2553 | 2577 | 2601 | 2625 | 2648 | 2672 | 2695 | 2718 | 2742 | 2765 | 2  | 5 | 7  | 9  | 12 | 14 | 16 | 19 | 21 |
| 19 | 2788 | 2810 | 2833 | 2856 | 2878 | 2900 | 2923 | 2945 | 2967 | 2989 | 2  | 4 | 7  | 9  | 11 | 13 | 16 | 18 | 20 |
| 20 | 3010 | 3032 | 3054 | 3075 | 3096 | 3118 | 3139 | 3160 | 3181 | 3201 | 2  | 4 | 6  | 8  | 11 | 13 | 15 | 17 | 19 |
| 21 | 3222 | 3243 | 3263 | 3284 | 3304 | 3324 | 3345 | 3365 | 3385 | 3404 | 2  | 4 | 6  | 8  | 10 | 12 | 14 | 16 | 18 |
| 22 | 3424 | 3444 | 3464 | 3483 | 3502 | 3522 | 3541 | 3560 | 3579 | 3598 | 2  | 4 | 6  | 8  | 10 | 12 | 14 | 15 | 17 |
| 23 | 3617 | 3636 | 3655 | 3674 | 3692 | 3711 | 3729 | 3747 | 3766 | 3784 | 2  | 4 | 6  | 7  | 9  | 11 | 13 | 15 | 17 |
| 24 | 3802 | 3820 | 3838 | 3856 | 3874 | 3892 | 3909 | 3927 | 3945 | 3962 | 2  | 4 | 5  | 7  | 9  | 11 | 12 | 14 | 16 |
| 25 | 3979 | 3997 | 4014 | 4031 | 4048 | 4065 | 4082 | 4099 | 4116 | 4133 | 2  | 3 | 5  | 7  | 9  | 10 | 12 | 14 | 15 |
| 26 | 4150 | 4166 | 4183 | 4200 | 4216 | 4232 | 4249 | 4265 | 4281 | 4298 | 2  | 3 | 5  | 7  | 8  | 10 | 11 | 13 | 15 |
| 27 | 4314 | 4330 | 4346 | 4362 | 4378 | 4393 | 4409 | 4425 | 4440 | 4456 | 2  | 3 | 5  | 6  | 8  | 9  | 11 | 13 | 14 |
| 28 | 4472 | 4487 | 4502 | 4518 | 4533 | 4548 | 4564 | 4579 | 4594 | 4609 | 2  | 3 | 5  | 6  | 8  | 9  | 11 | 12 | 14 |
| 29 | 4624 | 4639 | 4654 | 4669 | 4683 | 4698 | 4713 | 4728 | 4742 | 4757 | 1  | 3 | 4  | 6  | 7  | 9  | 10 | 12 | 13 |
| 30 | 4771 | 4786 | 4800 | 4814 | 4829 | 4843 | 4857 | 4871 | 4886 | 4900 | 1  | 3 | 4  | 6  | 7  | 9  | 10 | 11 | 13 |
| 31 | 4914 | 4928 | 4942 | 4955 | 4969 | 4983 | 4997 | 5011 | 5024 | 5038 | 1  | 3 | 4  | 6  | 7  | 8  | 10 | 11 | 12 |
| 32 | 5051 | 5065 | 5079 | 5092 | 5105 | 5119 | 5132 | 5145 | 5159 | 5172 | 1  | 3 | 4  | 5  | 7  | 8  | 9  | 11 | 12 |
| 33 | 5185 | 5198 | 5211 | 5224 | 5237 | 5250 | 5263 | 5276 | 5289 | 5302 | 1  | 3 | 4  | 5  | 6  | 8  | 9  | 10 | 12 |
| 34 | 5315 | 5328 | 5340 | 5353 | 5366 | 5378 | 5391 | 5403 | 5416 | 5428 | 1  | 3 | 4  | 5  | 6  | 8  | 9  | 10 | 11 |
| 35 | 5441 | 5453 | 5465 | 5478 | 5490 | 5502 | 5514 | 5527 | 5539 | 5551 | 1  | 2 | 4  | 5  | 6  | 7  | 9  | 10 | 11 |
| 36 | 5563 | 5575 | 5587 | 5599 | 5611 | 5623 | 5635 | 5647 | 5658 | 5670 | 1  | 2 | 4  | 5  | 6  | 7  | 8  | 10 | 11 |
| 37 | 5682 | 5694 | 5705 | 5717 | 5729 | 5740 | 5752 | 5763 | 5775 | 5786 | 1  | 2 | 3  | 5  | 6  | 7  | 8  | 9  | 10 |
| 38 | 5798 | 5809 | 5821 | 5832 | 5843 | 5855 | 5866 | 5877 | 5888 | 5899 | 1  | 2 | 3  | 5  | 6  | 7  | 8  | 9  | 10 |
| 39 | 5911 | 5922 | 5933 | 5944 | 5955 | 5966 | 5977 | 5988 | 5999 | 6010 | 1  | 2 | 3  | 4  | 5  | 7  | 8  | 9  | 10 |
| 40 | 6021 | 6031 | 6042 | 6053 | 6064 | 6075 | 6085 | 6096 | 6107 | 6117 | 1  | 2 | 3  | 4  | 5  | 6  | 8  | 9  | 10 |
| 41 | 6128 | 6138 | 6149 | 6160 | 6170 | 6180 | 6191 | 6201 | 6212 | 6222 | 1  | 2 | 3  | 4  | 5  | 6  | 7  | 8  | 9  |
| 42 | 6232 | 6243 | 6253 | 6263 | 6274 | 6284 | 6294 | 6304 | 6314 | 6325 | 1  | 2 | 3  | 4  | 5  | 6  | 7  | 8  | 9  |
| 43 | 6335 | 6345 | 6355 | 6365 | 6375 | 6385 | 6395 | 6405 | 6415 | 6425 | 1  | 2 | 3  | 4  | 5  | 6  | 7  | 8  | 9  |
| 44 | 6435 | 6444 | 6454 | 6464 | 6474 | 6484 | 6493 | 6503 | 6513 | 6522 | 1  | 2 | 3  | 4  | 5  | 6  | 7  | 8  | 9  |
| 45 | 6532 | 6542 | 6551 | 6561 | 6571 | 6580 | 6590 | 6599 | 6609 | 6618 | 1  | 2 | 3  | 4  | 5  | 6  | 7  | 8  | 9  |
| 46 | 6628 | 6637 | 6646 | 6656 | 6665 | 6675 | 6684 | 6693 | 6702 | 6712 | 1  | 2 | 3  | 4  | 5  | 6  | 7  | 7  | 8  |
| 47 | 6721 | 6730 | 6739 | 6749 | 6758 | 6767 | 6776 | 6785 | 6794 | 6803 | 1  | 2 | 3  | 4  | 5  | 5  | 6  | 7  | 8  |
| 48 | 6812 | 6821 | 6830 | 6839 | 6848 | 6857 | 6866 | 6875 | 6884 | 6893 | 1  | 2 | 3  | 4  | 4  | 5  | 6  | 7  | 8  |
| 49 | 6902 | 6911 | 6920 | 6928 | 6937 | 6946 | 6955 | 6964 | 6972 | 6981 | 1  | 2 | 3  | 4  | 4  | 5  | 6  | 7  | 8  |
| 50 | 6990 | 6998 | 7007 | 7016 | 7024 | 7033 | 7042 | 7050 | 7059 | 7067 | 1  | 2 | 3  | 3  | 4  | 5  | 6  | 7  | 8  |
| 51 | 7076 | 7084 | 7093 | 7101 | 7110 | 7118 | 7126 | 7135 | 7143 | 7152 | 1  | 2 | 3  | 3  | 4  | 5  | 6  | 7  | 8  |
| 52 | 7160 | 7168 | 7177 | 7185 | 7193 | 7202 | 7210 | 7218 | 7226 | 7235 | 1  | 2 | 2  | 3  | 4  | 5  | 6  | 7  | 7  |
| 53 | 7243 | 7251 | 7259 | 7267 | 7275 | 7284 | 7292 | 7300 | 7308 | 7316 | 1  | 2 | 2  | 3  | 4  | 5  | 6  | 6  | 7  |
| 54 | 7324 | 7332 | 7340 | 7348 | 7356 | 7364 | 7372 | 7380 | 7388 | 7396 | 1  | 2 | 2  | 3  | 4  | 5  | 6  | 6  | 7  |

# LOGARITHMS.

15

|    | 0    | 1    | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|----|------|------|------|------|------|------|------|------|------|------|---|---|---|---|---|---|---|---|---|
| 55 | 7404 | 7412 | 7419 | 7427 | 7435 | 7443 | 7451 | 7459 | 7466 | 7474 | 1 | 2 | 2 | 3 | 4 | 5 | 5 | 6 | 7 |
| 56 | 7482 | 7490 | 7497 | 7505 | 7513 | 7520 | 7528 | 7536 | 7543 | 7551 | 1 | 2 | 2 | 3 | 4 | 5 | 5 | 6 | 7 |
| 57 | 7559 | 7566 | 7574 | 7582 | 7589 | 7597 | 7604 | 7612 | 7619 | 7627 | 1 | 2 | 2 | 3 | 4 | 5 | 5 | 6 | 7 |
| 58 | 7634 | 7642 | 7649 | 7657 | 7664 | 7672 | 7679 | 7686 | 7694 | 7701 | 1 | 1 | 2 | 3 | 4 | 4 | 5 | 6 | 7 |
| 59 | 7709 | 7716 | 7723 | 7731 | 7738 | 7745 | 7752 | 7760 | 7767 | 7774 | 1 | 1 | 2 | 3 | 4 | 4 | 5 | 6 | 7 |
| 60 | 7782 | 7789 | 7796 | 7803 | 7810 | 7818 | 7825 | 7832 | 7839 | 7846 | 1 | 1 | 2 | 3 | 4 | 4 | 5 | 6 | 6 |
| 61 | 7853 | 7860 | 7868 | 7875 | 7882 | 7889 | 7896 | 7903 | 7910 | 7917 | 1 | 1 | 2 | 3 | 4 | 4 | 5 | 6 | 6 |
| 62 | 7924 | 7931 | 7938 | 7945 | 7952 | 7959 | 7966 | 7973 | 7980 | 7987 | 1 | 1 | 2 | 3 | 3 | 4 | 5 | 6 | 6 |
| 63 | 7993 | 8000 | 8007 | 8014 | 8021 | 8028 | 8035 | 8041 | 8048 | 8055 | 1 | 1 | 2 | 3 | 3 | 4 | 5 | 5 | 6 |
| 64 | 8062 | 8069 | 8075 | 8082 | 8089 | 8096 | 8102 | 8109 | 8116 | 8122 | 1 | 1 | 2 | 3 | 3 | 4 | 5 | 5 | 6 |
| 65 | 8129 | 8136 | 8142 | 8149 | 8156 | 8162 | 8169 | 8176 | 8182 | 8189 | 1 | 1 | 2 | 3 | 3 | 4 | 5 | 5 | 6 |
| 66 | 8195 | 8202 | 8209 | 8215 | 8222 | 8228 | 8235 | 8241 | 8248 | 8254 | 1 | 1 | 2 | 3 | 3 | 4 | 5 | 5 | 6 |
| 67 | 8261 | 8267 | 8274 | 8280 | 8287 | 8293 | 8299 | 8306 | 8312 | 8319 | 1 | 1 | 2 | 3 | 3 | 4 | 5 | 5 | 6 |
| 68 | 8325 | 8331 | 8338 | 8344 | 8351 | 8357 | 8363 | 8370 | 8376 | 8382 | 1 | 1 | 2 | 3 | 3 | 4 | 4 | 5 | 6 |
| 69 | 8388 | 8395 | 8401 | 8407 | 8414 | 8420 | 8426 | 8432 | 8439 | 8445 | 1 | 1 | 2 | 2 | 3 | 4 | 4 | 5 | 6 |
| 70 | 8451 | 8457 | 8463 | 8470 | 8476 | 8482 | 8488 | 8494 | 8500 | 8506 | 1 | 1 | 2 | 2 | 3 | 4 | 4 | 5 | 6 |
| 71 | 8513 | 8519 | 8525 | 8531 | 8537 | 8543 | 8549 | 8555 | 8561 | 8567 | 1 | 1 | 2 | 2 | 3 | 4 | 4 | 5 | 5 |
| 72 | 8573 | 8579 | 8585 | 8591 | 8597 | 8603 | 8609 | 8615 | 8621 | 8627 | 1 | 1 | 2 | 2 | 3 | 4 | 4 | 5 | 5 |
| 73 | 8633 | 8639 | 8645 | 8651 | 8657 | 8663 | 8669 | 8675 | 8681 | 8686 | 1 | 1 | 2 | 2 | 3 | 4 | 4 | 5 | 5 |
| 74 | 8692 | 8698 | 8704 | 8710 | 8716 | 8722 | 8727 | 8733 | 8739 | 8745 | 1 | 1 | 2 | 2 | 3 | 4 | 4 | 5 | 5 |
| 75 | 8751 | 8756 | 8762 | 8768 | 8774 | 8779 | 8785 | 8791 | 8797 | 8802 | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 5 | 5 |
| 76 | 8808 | 8814 | 8820 | 8825 | 8831 | 8837 | 8842 | 8848 | 8854 | 8859 | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 5 | 5 |
| 77 | 8865 | 8871 | 8876 | 8882 | 8887 | 8893 | 8899 | 8904 | 8910 | 8915 | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 | 5 |
| 78 | 8921 | 8927 | 8932 | 8938 | 8943 | 8949 | 8954 | 8960 | 8965 | 8971 | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 | 5 |
| 79 | 8976 | 8982 | 8987 | 8993 | 8998 | 9004 | 9009 | 9015 | 9020 | 9025 | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 | 5 |
| 80 | 9031 | 9036 | 9042 | 9047 | 9053 | 9058 | 9063 | 9069 | 9074 | 9079 | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 | 5 |
| 81 | 9085 | 9090 | 9096 | 9101 | 9106 | 9112 | 9117 | 9122 | 9128 | 9133 | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 | 5 |
| 82 | 9138 | 9143 | 9149 | 9154 | 9159 | 9165 | 9170 | 9175 | 9180 | 9186 | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 | 5 |
| 83 | 9191 | 9196 | 9201 | 9206 | 9212 | 9217 | 9222 | 9227 | 9232 | 9238 | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 | 5 |
| 84 | 9243 | 9248 | 9253 | 9258 | 9263 | 9269 | 9274 | 9279 | 9284 | 9289 | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 | 5 |
| 85 | 9294 | 9299 | 9304 | 9309 | 9315 | 9320 | 9325 | 9330 | 9335 | 9340 | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 | 5 |
| 86 | 9345 | 9350 | 9355 | 9360 | 9365 | 9370 | 9375 | 9380 | 9385 | 9390 | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 | 5 |
| 87 | 9395 | 9400 | 9405 | 9410 | 9415 | 9420 | 9425 | 9430 | 9435 | 9440 | 0 | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 |
| 88 | 9445 | 9450 | 9455 | 9460 | 9465 | 9469 | 9474 | 9479 | 9484 | 9489 | 0 | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 |
| 89 | 9494 | 9499 | 9504 | 9509 | 9513 | 9518 | 9523 | 9528 | 9533 | 9538 | 0 | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 |
| 90 | 9542 | 9547 | 9552 | 9557 | 9562 | 9566 | 9571 | 9576 | 9581 | 9586 | 0 | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 |
| 91 | 9590 | 9595 | 9600 | 9605 | 9609 | 9614 | 9619 | 9624 | 9628 | 9633 | 0 | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 |
| 92 | 9638 | 9643 | 9647 | 9652 | 9657 | 9661 | 9666 | 9671 | 9675 | 9680 | 0 | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 |
| 93 | 9685 | 9689 | 9694 | 9699 | 9703 | 9708 | 9713 | 9717 | 9722 | 9727 | 0 | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 |
| 94 | 9731 | 9736 | 9741 | 9745 | 9750 | 9754 | 9759 | 9763 | 9768 | 9773 | 0 | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 |
| 95 | 9777 | 9782 | 9786 | 9791 | 9795 | 9800 | 9805 | 9809 | 9814 | 9818 | 0 | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 |
| 96 | 9823 | 9827 | 9832 | 9836 | 9841 | 9845 | 9850 | 9854 | 9859 | 9863 | 0 | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 |
| 97 | 9868 | 9872 | 9877 | 9881 | 9886 | 9890 | 9894 | 9899 | 9903 | 9908 | 0 | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 |
| 98 | 9912 | 9917 | 9921 | 9926 | 9930 | 9934 | 9939 | 9943 | 9948 | 9952 | 0 | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 |
| 99 | 9956 | 9961 | 9965 | 9969 | 9974 | 9978 | 9983 | 9987 | 9991 | 9996 | 0 | 1 | 1 | 2 | 2 | 3 | 3 | 3 | 4 |



## LOGARITHMS OF RECIPROCAL.

|    | 0    | 1    | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 1 2 3  | 4 5 6    | 7 8 9    |
|----|------|------|------|------|------|------|------|------|------|------|--------|----------|----------|
| 10 |      | 9957 | 9914 | 9872 | 9830 | 9788 | 9747 | 9706 | 9666 | 9626 | 4 8 12 | 17 21 25 | 29 33 37 |
| 11 | 9586 | 9547 | 9508 | 9469 | 9431 | 9393 | 9355 | 9318 | 9281 | 9245 | 4 8 11 | 15 19 23 | 26 30 34 |
| 12 | 9208 | 9172 | 9136 | 9101 | 9066 | 9031 | 8996 | 8962 | 8928 | 8894 | 3 7 10 | 14 17 21 | 24 28 31 |
| 13 | 8861 | 8827 | 8794 | 8761 | 8729 | 8697 | 8665 | 8633 | 8601 | 8570 | 3 6 10 | 13 16 19 | 23 26 29 |
| 14 | 8539 | 8508 | 8477 | 8447 | 8416 | 8386 | 8356 | 8327 | 8297 | 8268 | 3 6 9  | 12 15 18 | 21 24 27 |
| 15 | 8239 | 8210 | 8182 | 8153 | 8125 | 8097 | 8069 | 8041 | 8013 | 7986 | 3 6 8  | 11 14 17 | 20 22 25 |
| 16 | 7959 | 7932 | 7905 | 7878 | 7852 | 7825 | 7799 | 7773 | 7747 | 7721 | 3 5 8  | 11 13 16 | 18 21 24 |
| 17 | 7696 | 7670 | 7645 | 7620 | 7595 | 7570 | 7545 | 7520 | 7496 | 7471 | 2 5 7  | 10 12 15 | 17 20 22 |
| 18 | 7447 | 7423 | 7399 | 7375 | 7352 | 7328 | 7305 | 7282 | 7258 | 7235 | 2 5 7  | 9 12 14  | 16 19 21 |
| 19 | 7212 | 7190 | 7167 | 7144 | 7122 | 7100 | 7077 | 7055 | 7033 | 7011 | 2 4 7  | 9 11 13  | 16 18 20 |
| 20 | 6990 | 6968 | 6946 | 6925 | 6904 | 6882 | 6861 | 6840 | 6819 | 6799 | 2 4 6  | 8 11 13  | 15 17 19 |
| 21 | 6778 | 6757 | 6737 | 6716 | 6696 | 6676 | 6655 | 6635 | 6615 | 6596 | 2 4 6  | 8 10 12  | 14 16 18 |
| 22 | 6576 | 6556 | 6536 | 6517 | 6497 | 6478 | 6459 | 6440 | 6421 | 6402 | 2 4 6  | 8 10 12  | 14 15 17 |
| 23 | 6383 | 6364 | 6345 | 6326 | 6308 | 6289 | 6271 | 6253 | 6234 | 6216 | 2 4 6  | 7 9 11   | 13 15 17 |
| 24 | 6198 | 6180 | 6162 | 6144 | 6126 | 6108 | 6091 | 6073 | 6055 | 6038 | 2 4 5  | 7 9 11   | 12 14 16 |
| 25 | 6021 | 6003 | 5986 | 5969 | 5952 | 5935 | 5918 | 5901 | 5884 | 5867 | 2 3 5  | 7 9 10   | 12 14 15 |
| 26 | 5850 | 5834 | 5817 | 5800 | 5784 | 5768 | 5751 | 5735 | 5719 | 5702 | 2 3 5  | 7 8 10   | 11 13 15 |
| 27 | 5686 | 5670 | 5654 | 5638 | 5622 | 5607 | 5591 | 5575 | 5560 | 5544 | 2 3 5  | 6 8 9    | 11 13 14 |
| 28 | 5528 | 5513 | 5498 | 5482 | 5467 | 5452 | 5436 | 5421 | 5406 | 5391 | 2 3 5  | 6 8 9    | 11 12 14 |
| 29 | 5376 | 5361 | 5346 | 5331 | 5317 | 5302 | 5287 | 5272 | 5258 | 5243 | 1 3 4  | 6 7 9    | 10 12 13 |
| 30 | 5229 | 5214 | 5200 | 5186 | 5171 | 5157 | 5143 | 5129 | 5114 | 5100 | 1 3 4  | 6 7 9    | 10 11 13 |
| 31 | 5086 | 5072 | 5058 | 5045 | 5031 | 5017 | 5003 | 4989 | 4976 | 4962 | 1 3 4  | 6 7 8    | 10 11 12 |
| 32 | 4948 | 4935 | 4921 | 4908 | 4895 | 4881 | 4868 | 4855 | 4841 | 4828 | 1 3 4  | 5 7 8    | 9 11 12  |
| 33 | 4815 | 4802 | 4789 | 4776 | 4763 | 4750 | 4737 | 4724 | 4711 | 4698 | 1 3 4  | 5 6 8    | 9 10 12  |
| 34 | 4685 | 4672 | 4660 | 4647 | 4634 | 4622 | 4609 | 4597 | 4584 | 4572 | 1 3 4  | 5 6 8    | 9 10 11  |
| 35 | 4559 | 4547 | 4535 | 4522 | 4510 | 4498 | 4486 | 4473 | 4461 | 4449 | 1 2 4  | 5 6 7    | 9 10 11  |
| 36 | 4437 | 4425 | 4413 | 4401 | 4389 | 4377 | 4365 | 4353 | 4342 | 4330 | 1 2 4  | 5 6 7    | 9 10 11  |
| 37 | 4318 | 4306 | 4295 | 4283 | 4271 | 4260 | 4248 | 4237 | 4225 | 4214 | 1 2 3  | 5 6 7    | 8 9 10   |
| 38 | 4202 | 4191 | 4179 | 4168 | 4157 | 4145 | 4134 | 4123 | 4112 | 4101 | 1 2 3  | 5 6 7    | 8 9 10   |
| 39 | 4089 | 4078 | 4067 | 4056 | 4045 | 4034 | 4023 | 4012 | 4001 | 3990 | 1 2 3  | 4 6 7    | 8 9 10   |
| 40 | 3979 | 3969 | 3958 | 3947 | 3936 | 3925 | 3915 | 3904 | 3893 | 3883 | 1 2 3  | 4 5 6    | 7 8 9    |
| 41 | 3872 | 3862 | 3851 | 3840 | 3830 | 3820 | 3809 | 3799 | 3788 | 3778 | 1 2 3  | 4 5 6    | 7 8 9    |
| 42 | 3768 | 3757 | 3747 | 3737 | 3726 | 3716 | 3706 | 3696 | 3686 | 3675 | 1 2 3  | 4 5 6    | 7 8 9    |
| 43 | 3665 | 3655 | 3645 | 3635 | 3625 | 3615 | 3605 | 3595 | 3585 | 3575 | 1 2 3  | 4 5 6    | 7 8 9    |
| 44 | 3565 | 3556 | 3546 | 3536 | 3526 | 3516 | 3507 | 3497 | 3487 | 3478 | 1 2 3  | 4 5 6    | 7 8 9    |
| 45 | 3468 | 3458 | 3449 | 3439 | 3429 | 3420 | 3410 | 3401 | 3391 | 3382 | 1 2 3  | 4 5 6    | 7 8 9    |
| 46 | 3372 | 3363 | 3354 | 3344 | 3335 | 3325 | 3316 | 3307 | 3298 | 3288 | 1 2 3  | 4 5 6    | 7 7 8    |
| 47 | 3279 | 3270 | 3261 | 3251 | 3242 | 3233 | 3224 | 3215 | 3206 | 3197 | 1 2 3  | 4 5 5    | 6 7 8    |
| 48 | 3188 | 3179 | 3170 | 3161 | 3152 | 3143 | 3134 | 3125 | 3116 | 3107 | 1 2 3  | 4 4 5    | 6 7 8    |
| 49 | 3098 | 3089 | 3080 | 3071 | 3063 | 3054 | 3045 | 3036 | 3028 | 3019 | 1 2 3  | 4 4 5    | 6 7 8    |
| 50 | 3010 | 3002 | 2993 | 2984 | 2976 | 2967 | 2958 | 2950 | 2941 | 2933 | 1 2 3  | 3 4 5    | 6 7 8    |
| 51 | 2924 | 2916 | 2907 | 2899 | 2890 | 2882 | 2874 | 2865 | 2857 | 2848 | 1 2 3  | 3 4 5    | 6 7 8    |
| 52 | 2840 | 2832 | 2823 | 2815 | 2807 | 2798 | 2790 | 2782 | 2774 | 2765 | 1 2 2  | 3 4 5    | 6 7 7    |
| 53 | 2757 | 2749 | 2741 | 2733 | 2725 | 2716 | 2708 | 2700 | 2692 | 2684 | 1 2 2  | 3 4 5    | 6 6 7    |
| 54 | 2676 | 2668 | 2660 | 2652 | 2644 | 2636 | 2628 | 2620 | 2612 | 2604 | 1 2 2  | 3 4 5    | 6 6 7    |

N.B.—Numbers in Difference Columns to be Subtracted, not Added.

# LOGARITHMS OF RECIPROCAL.

17

LOGARITHMS OF RECIPROCAL.

|    | 0    | 1    | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 1 2 3 | 4 5 6 | 7 8 9 |
|----|------|------|------|------|------|------|------|------|------|------|-------|-------|-------|
| 55 | 2596 | 2588 | 2581 | 2573 | 2565 | 2557 | 2549 | 2541 | 2534 | 2526 | 1 2 2 | 3 4 5 | 5 6 7 |
| 56 | 2518 | 2510 | 2503 | 2495 | 2487 | 2480 | 2472 | 2464 | 2457 | 2449 | 1 2 2 | 3 4 5 | 5 6 7 |
| 57 | 2441 | 2434 | 2426 | 2418 | 2411 | 2403 | 2396 | 2388 | 2381 | 2373 | 1 2 2 | 3 4 5 | 5 6 7 |
| 58 | 2366 | 2358 | 2351 | 2343 | 2336 | 2328 | 2321 | 2314 | 2306 | 2299 | 1 1 2 | 3 4 4 | 5 6 7 |
| 59 | 2291 | 2284 | 2277 | 2269 | 2262 | 2255 | 2248 | 2240 | 2233 | 2226 | 1 1 2 | 3 4 4 | 5 6 7 |
| 60 | 2218 | 2211 | 2204 | 2197 | 2190 | 2182 | 2175 | 2168 | 2161 | 2154 | 1 1 2 | 3 4 4 | 5 6 6 |
| 61 | 2147 | 2140 | 2132 | 2125 | 2118 | 2111 | 2104 | 2097 | 2090 | 2083 | 1 1 2 | 3 4 4 | 5 6 6 |
| 62 | 2076 | 2069 | 2062 | 2055 | 2048 | 2041 | 2034 | 2027 | 2020 | 2013 | 1 1 2 | 3 3 4 | 5 6 6 |
| 63 | 2007 | 2000 | 1993 | 1986 | 1979 | 1972 | 1965 | 1959 | 1952 | 1945 | 1 1 2 | 3 3 4 | 5 5 6 |
| 64 | 1938 | 1931 | 1925 | 1918 | 1911 | 1904 | 1898 | 1891 | 1884 | 1878 | 1 1 2 | 3 3 4 | 5 5 6 |
| 65 | 1871 | 1864 | 1858 | 1851 | 1844 | 1838 | 1831 | 1824 | 1818 | 1811 | 1 1 2 | 3 3 4 | 5 5 6 |
| 66 | 1805 | 1798 | 1791 | 1785 | 1778 | 1772 | 1765 | 1759 | 1752 | 1746 | 1 1 2 | 3 3 4 | 5 5 6 |
| 67 | 1739 | 1733 | 1726 | 1720 | 1713 | 1707 | 1701 | 1694 | 1688 | 1681 | 1 1 2 | 3 3 4 | 4 5 6 |
| 68 | 1675 | 1669 | 1662 | 1656 | 1649 | 1643 | 1637 | 1630 | 1624 | 1618 | 1 1 2 | 3 3 4 | 4 5 6 |
| 69 | 1612 | 1605 | 1599 | 1593 | 1586 | 1580 | 1574 | 1568 | 1561 | 1555 | 1 1 2 | 3 3 4 | 4 5 6 |
| 70 | 1549 | 1543 | 1537 | 1530 | 1524 | 1518 | 1512 | 1506 | 1500 | 1494 | 1 1 2 | 2 3 4 | 4 5 5 |
| 71 | 1487 | 1481 | 1475 | 1469 | 1463 | 1457 | 1451 | 1445 | 1439 | 1433 | 1 1 2 | 2 3 4 | 4 5 5 |
| 72 | 1427 | 1421 | 1415 | 1409 | 1403 | 1397 | 1391 | 1385 | 1379 | 1373 | 1 1 2 | 2 3 4 | 4 5 5 |
| 73 | 1367 | 1361 | 1355 | 1349 | 1343 | 1337 | 1331 | 1325 | 1319 | 1314 | 1 1 2 | 2 3 4 | 4 5 5 |
| 74 | 1308 | 1302 | 1296 | 1290 | 1284 | 1278 | 1273 | 1267 | 1261 | 1255 | 1 1 2 | 2 3 3 | 4 5 5 |
| 75 | 1249 | 1244 | 1238 | 1232 | 1226 | 1221 | 1215 | 1209 | 1203 | 1198 | 1 1 2 | 2 3 3 | 4 5 5 |
| 76 | 1192 | 1186 | 1180 | 1175 | 1169 | 1163 | 1158 | 1152 | 1146 | 1141 | 1 1 2 | 2 3 3 | 4 5 5 |
| 77 | 1135 | 1129 | 1124 | 1118 | 1113 | 1107 | 1101 | 1096 | 1090 | 1085 | 1 1 2 | 2 3 3 | 4 4 5 |
| 78 | 1079 | 1073 | 1068 | 1062 | 1057 | 1051 | 1046 | 1040 | 1035 | 1029 | 1 1 2 | 2 3 3 | 4 4 5 |
| 79 | 1024 | 1018 | 1013 | 1007 | 1002 | 0996 | 0991 | 0985 | 0980 | 0975 | 1 1 2 | 2 3 3 | 4 4 5 |
| 80 | 0969 | 0964 | 0958 | 0953 | 0947 | 0942 | 0937 | 0931 | 0926 | 0921 | 1 1 2 | 2 3 3 | 4 4 5 |
| 81 | 0915 | 0910 | 0904 | 0899 | 0894 | 0888 | 0883 | 0878 | 0872 | 0867 | 1 1 2 | 2 3 3 | 4 4 5 |
| 82 | 0862 | 0857 | 0851 | 0846 | 0841 | 0835 | 0830 | 0825 | 0820 | 0814 | 1 1 2 | 2 3 3 | 4 4 5 |
| 83 | 0809 | 0804 | 0799 | 0794 | 0788 | 0783 | 0778 | 0773 | 0768 | 0762 | 1 1 2 | 2 3 3 | 4 4 5 |
| 84 | 0757 | 0752 | 0747 | 0742 | 0737 | 0731 | 0726 | 0721 | 0716 | 0711 | 1 1 2 | 2 3 3 | 4 4 5 |
| 85 | 0706 | 0701 | 0696 | 0691 | 0685 | 0680 | 0675 | 0670 | 0665 | 0660 | 1 1 2 | 2 3 3 | 4 4 5 |
| 86 | 0655 | 0650 | 0645 | 0640 | 0635 | 0630 | 0625 | 0620 | 0615 | 0610 | 1 1 2 | 2 3 3 | 4 4 5 |
| 87 | 0605 | 0600 | 0595 | 0590 | 0585 | 0580 | 0575 | 0570 | 0565 | 0560 | 0 1 1 | 2 2 3 | 3 4 4 |
| 88 | 0555 | 0550 | 0545 | 0540 | 0535 | 0531 | 0526 | 0521 | 0516 | 0511 | 0 1 1 | 2 2 3 | 3 4 4 |
| 89 | 0506 | 0501 | 0496 | 0491 | 0487 | 0482 | 0477 | 0472 | 0467 | 0462 | 0 1 1 | 2 2 3 | 3 4 4 |
| 90 | 0458 | 0453 | 0448 | 0443 | 0438 | 0434 | 0429 | 0424 | 0419 | 0414 | 0 1 1 | 2 2 3 | 3 4 4 |
| 91 | 0410 | 0405 | 0400 | 0395 | 0391 | 0386 | 0381 | 0376 | 0372 | 0367 | 0 1 1 | 2 2 3 | 3 4 4 |
| 92 | 0362 | 0357 | 0353 | 0348 | 0343 | 0339 | 0334 | 0329 | 0325 | 0320 | 0 1 1 | 2 2 3 | 3 4 4 |
| 93 | 0315 | 0311 | 0306 | 0301 | 0297 | 0292 | 0287 | 0283 | 0278 | 0273 | 0 1 1 | 2 2 3 | 3 4 4 |
| 94 | 0269 | 0264 | 0259 | 0255 | 0250 | 0246 | 0241 | 0237 | 0232 | 0227 | 0 1 1 | 2 2 3 | 3 4 4 |
| 95 | 0223 | 0218 | 0214 | 0209 | 0205 | 0200 | 0195 | 0191 | 0186 | 0182 | 0 1 1 | 2 2 3 | 3 4 4 |
| 96 | 0177 | 0173 | 0168 | 0164 | 0159 | 0155 | 0150 | 0146 | 0141 | 0137 | 0 1 1 | 2 2 3 | 3 4 4 |
| 97 | 0132 | 0128 | 0123 | 0119 | 0114 | 0110 | 0106 | 0101 | 0097 | 0092 | 0 1 1 | 2 2 3 | 3 4 4 |
| 98 | 0088 | 0083 | 0079 | 0074 | 0070 | 0066 | 0061 | 0057 | 0052 | 0048 | 0 1 1 | 2 2 3 | 3 4 4 |
| 99 | 0044 | 0039 | 0035 | 0031 | 0026 | 0022 | 0017 | 0013 | 0009 | 0004 | 0 1 1 | 2 2 3 | 3 3 4 |

N.B.—Numbers in Difference Columns to be Subtracted, not Added.

|     | 0    | 1    | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|-----|------|------|------|------|------|------|------|------|------|------|---|---|---|---|---|---|---|---|---|
| *00 | 1000 | 1002 | 1005 | 1007 | 1009 | 1012 | 1014 | 1016 | 1019 | 1021 | 0 | 0 | 1 | 1 | 1 | 1 | 2 | 2 | 2 |
| *01 | 1023 | 1026 | 1028 | 1030 | 1033 | 1035 | 1038 | 1040 | 1042 | 1045 | 0 | 0 | 1 | 1 | 1 | 1 | 2 | 2 | 2 |
| *02 | 1047 | 1050 | 1052 | 1054 | 1057 | 1059 | 1062 | 1064 | 1067 | 1069 | 0 | 0 | 1 | 1 | 1 | 1 | 2 | 2 | 2 |
| *03 | 1072 | 1074 | 1076 | 1079 | 1081 | 1084 | 1086 | 1089 | 1091 | 1094 | 0 | 0 | 1 | 1 | 1 | 1 | 2 | 2 | 2 |
| *04 | 1096 | 1099 | 1102 | 1104 | 1107 | 1109 | 1112 | 1114 | 1117 | 1119 | 0 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 |
| *05 | 1122 | 1125 | 1127 | 1130 | 1132 | 1135 | 1138 | 1140 | 1143 | 1146 | 0 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 |
| *06 | 1148 | 1151 | 1153 | 1156 | 1159 | 1161 | 1164 | 1167 | 1169 | 1172 | 0 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 |
| *07 | 1175 | 1178 | 1180 | 1183 | 1186 | 1189 | 1191 | 1194 | 1197 | 1199 | 0 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 |
| *08 | 1202 | 1205 | 1208 | 1211 | 1213 | 1216 | 1219 | 1222 | 1225 | 1227 | 0 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 3 |
| *09 | 1230 | 1233 | 1236 | 1239 | 1242 | 1245 | 1247 | 1250 | 1253 | 1256 | 0 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 3 |
| *10 | 1259 | 1262 | 1265 | 1268 | 1271 | 1274 | 1276 | 1279 | 1282 | 1285 | 0 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 3 |
| *11 | 1288 | 1291 | 1294 | 1297 | 1300 | 1303 | 1306 | 1309 | 1312 | 1315 | 0 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 3 |
| *12 | 1318 | 1321 | 1324 | 1327 | 1330 | 1334 | 1337 | 1340 | 1343 | 1346 | 0 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 3 |
| *13 | 1349 | 1352 | 1355 | 1358 | 1361 | 1365 | 1368 | 1371 | 1374 | 1377 | 0 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 |
| *14 | 1380 | 1384 | 1387 | 1390 | 1393 | 1396 | 1400 | 1403 | 1406 | 1409 | 0 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 |
| *15 | 1413 | 1416 | 1419 | 1422 | 1426 | 1429 | 1432 | 1435 | 1439 | 1442 | 0 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 |
| *16 | 1445 | 1449 | 1452 | 1455 | 1459 | 1462 | 1466 | 1469 | 1472 | 1476 | 0 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 |
| *17 | 1479 | 1483 | 1486 | 1489 | 1493 | 1496 | 1500 | 1503 | 1507 | 1510 | 0 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 |
| *18 | 1514 | 1517 | 1521 | 1524 | 1528 | 1531 | 1535 | 1538 | 1542 | 1545 | 0 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 |
| *19 | 1549 | 1552 | 1556 | 1560 | 1563 | 1567 | 1570 | 1574 | 1578 | 1581 | 0 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 |
| *20 | 1585 | 1589 | 1592 | 1596 | 1600 | 1603 | 1607 | 1611 | 1614 | 1618 | 0 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 |
| *21 | 1622 | 1626 | 1629 | 1633 | 1637 | 1641 | 1644 | 1648 | 1652 | 1656 | 0 | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 3 |
| *22 | 1660 | 1663 | 1667 | 1671 | 1675 | 1679 | 1683 | 1687 | 1690 | 1694 | 0 | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 3 |
| *23 | 1698 | 1702 | 1706 | 1710 | 1714 | 1718 | 1722 | 1726 | 1730 | 1734 | 0 | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 3 |
| *24 | 1738 | 1742 | 1746 | 1750 | 1754 | 1758 | 1762 | 1766 | 1770 | 1774 | 0 | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 3 |
| *25 | 1778 | 1782 | 1786 | 1791 | 1795 | 1799 | 1803 | 1807 | 1811 | 1816 | 0 | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 3 |
| *26 | 1820 | 1824 | 1828 | 1832 | 1837 | 1841 | 1845 | 1849 | 1854 | 1858 | 0 | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 3 |
| *27 | 1862 | 1866 | 1871 | 1875 | 1879 | 1884 | 1888 | 1892 | 1897 | 1901 | 0 | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 3 |
| *28 | 1905 | 1910 | 1914 | 1919 | 1923 | 1928 | 1932 | 1936 | 1941 | 1945 | 0 | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 3 |
| *29 | 1950 | 1954 | 1959 | 1963 | 1968 | 1972 | 1977 | 1982 | 1986 | 1991 | 0 | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 3 |
| *30 | 1995 | 2000 | 2004 | 2009 | 2014 | 2018 | 2023 | 2028 | 2032 | 2037 | 0 | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 3 |
| *31 | 2042 | 2046 | 2051 | 2056 | 2061 | 2065 | 2070 | 2075 | 2080 | 2084 | 0 | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 3 |
| *32 | 2089 | 2094 | 2099 | 2104 | 2109 | 2113 | 2118 | 2123 | 2128 | 2133 | 0 | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 3 |
| *33 | 2138 | 2143 | 2148 | 2153 | 2158 | 2163 | 2168 | 2173 | 2178 | 2183 | 0 | 1 | 1 | 2 | 2 | 2 | 2 | 3 | 3 |
| *34 | 2188 | 2193 | 2198 | 2203 | 2208 | 2213 | 2218 | 2223 | 2228 | 2234 | 1 | 1 | 2 | 2 | 3 | 3 | 3 | 4 | 4 |
| *35 | 2239 | 2244 | 2249 | 2254 | 2259 | 2265 | 2270 | 2275 | 2280 | 2286 | 1 | 1 | 2 | 2 | 3 | 3 | 3 | 4 | 4 |
| *36 | 2291 | 2296 | 2301 | 2307 | 2312 | 2317 | 2323 | 2328 | 2333 | 2339 | 1 | 1 | 2 | 2 | 3 | 3 | 3 | 4 | 4 |
| *37 | 2344 | 2350 | 2355 | 2360 | 2366 | 2371 | 2377 | 2382 | 2388 | 2393 | 1 | 1 | 2 | 2 | 3 | 3 | 3 | 4 | 4 |
| *38 | 2399 | 2404 | 2410 | 2415 | 2421 | 2427 | 2432 | 2438 | 2443 | 2449 | 1 | 1 | 2 | 2 | 3 | 3 | 3 | 4 | 4 |
| *39 | 2455 | 2460 | 2466 | 2472 | 2477 | 2483 | 2489 | 2495 | 2500 | 2506 | 1 | 1 | 2 | 2 | 3 | 3 | 3 | 4 | 4 |
| *40 | 2512 | 2518 | 2523 | 2529 | 2535 | 2541 | 2547 | 2553 | 2559 | 2564 | 1 | 1 | 2 | 2 | 3 | 3 | 3 | 4 | 4 |
| *41 | 2570 | 2576 | 2582 | 2588 | 2594 | 2600 | 2606 | 2612 | 2618 | 2624 | 1 | 1 | 2 | 2 | 3 | 3 | 3 | 4 | 4 |
| *42 | 2630 | 2636 | 2642 | 2649 | 2655 | 2661 | 2667 | 2673 | 2679 | 2685 | 1 | 1 | 2 | 2 | 3 | 3 | 3 | 4 | 4 |
| *43 | 2692 | 2698 | 2704 | 2710 | 2716 | 2723 | 2729 | 2735 | 2742 | 2748 | 1 | 1 | 2 | 2 | 3 | 3 | 3 | 4 | 4 |
| *44 | 2754 | 2761 | 2767 | 2773 | 2780 | 2786 | 2793 | 2799 | 2805 | 2812 | 1 | 1 | 2 | 2 | 3 | 3 | 3 | 4 | 4 |
| *45 | 2818 | 2825 | 2831 | 2838 | 2844 | 2851 | 2858 | 2864 | 2871 | 2877 | 1 | 1 | 2 | 2 | 3 | 3 | 3 | 4 | 4 |
| *46 | 2884 | 2891 | 2897 | 2904 | 2911 | 2917 | 2924 | 2931 | 2938 | 2944 | 1 | 1 | 2 | 2 | 3 | 3 | 3 | 4 | 4 |
| *47 | 2951 | 2958 | 2965 | 2972 | 2979 | 2985 | 2992 | 2999 | 3006 | 3013 | 1 | 1 | 2 | 2 | 3 | 3 | 3 | 4 | 4 |
| *48 | 3020 | 3027 | 3034 | 3041 | 3048 | 3055 | 3062 | 3069 | 3076 | 3083 | 1 | 1 | 2 | 2 | 3 | 3 | 3 | 4 | 4 |
| *49 | 3090 | 3097 | 3105 | 3112 | 3119 | 3126 | 3133 | 3141 | 3148 | 3155 | 1 | 1 | 2 | 2 | 3 | 3 | 3 | 4 | 4 |



# ANTILOGARITHMS.

19

|    | 0    | 1    | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 1 | 2 | 3 | 4 | 5  | 6  | 7  | 8  | 9  |
|----|------|------|------|------|------|------|------|------|------|------|---|---|---|---|----|----|----|----|----|
| 50 | 3162 | 3170 | 3177 | 3184 | 3192 | 3199 | 3206 | 3214 | 3221 | 3228 | 1 | 1 | 2 | 3 | 4  | 4  | 5  | 6  | 7  |
| 51 | 3236 | 3243 | 3251 | 3258 | 3266 | 3273 | 3281 | 3289 | 3296 | 3304 | 1 | 2 | 2 | 3 | 4  | 5  | 5  | 6  | 7  |
| 52 | 3311 | 3319 | 3327 | 3334 | 3342 | 3350 | 3357 | 3365 | 3373 | 3381 | 1 | 2 | 2 | 3 | 4  | 5  | 5  | 6  | 7  |
| 53 | 3388 | 3396 | 3404 | 3412 | 3420 | 3428 | 3436 | 3443 | 3451 | 3459 | 1 | 2 | 2 | 3 | 4  | 5  | 6  | 6  | 7  |
| 54 | 3467 | 3475 | 3483 | 3491 | 3499 | 3508 | 3516 | 3524 | 3532 | 3540 | 1 | 2 | 2 | 3 | 4  | 5  | 6  | 6  | 7  |
| 55 | 3548 | 3556 | 3565 | 3573 | 3581 | 3589 | 3597 | 3606 | 3614 | 3622 | 1 | 2 | 2 | 3 | 4  | 5  | 6  | 7  | 7  |
| 56 | 3631 | 3639 | 3648 | 3656 | 3664 | 3673 | 3681 | 3690 | 3698 | 3707 | 1 | 2 | 3 | 3 | 4  | 5  | 6  | 7  | 8  |
| 57 | 3715 | 3724 | 3733 | 3741 | 3750 | 3758 | 3767 | 3776 | 3784 | 3793 | 1 | 2 | 3 | 3 | 4  | 5  | 6  | 7  | 8  |
| 58 | 3802 | 3811 | 3819 | 3828 | 3837 | 3846 | 3855 | 3864 | 3873 | 3882 | 1 | 2 | 3 | 4 | 4  | 5  | 6  | 7  | 8  |
| 59 | 3890 | 3899 | 3908 | 3917 | 3926 | 3936 | 3945 | 3954 | 3963 | 3972 | 1 | 2 | 3 | 4 | 5  | 5  | 6  | 7  | 8  |
| 60 | 3981 | 3990 | 3999 | 4009 | 4018 | 4027 | 4036 | 4046 | 4055 | 4064 | 1 | 2 | 3 | 4 | 5  | 6  | 0  | 7  | 8  |
| 61 | 4074 | 4083 | 4093 | 4102 | 4111 | 4121 | 4130 | 4140 | 4150 | 4159 | 1 | 2 | 3 | 4 | 5  | 6  | 7  | 8  | 9  |
| 62 | 4169 | 4178 | 4188 | 4198 | 4207 | 4217 | 4227 | 4236 | 4246 | 4256 | 1 | 2 | 3 | 4 | 5  | 6  | 7  | 8  | 9  |
| 63 | 4266 | 4276 | 4285 | 4295 | 4305 | 4315 | 4325 | 4335 | 4345 | 4355 | 1 | 2 | 3 | 4 | 5  | 6  | 7  | 8  | 9  |
| 64 | 4365 | 4375 | 4385 | 4395 | 4406 | 4416 | 4426 | 4436 | 4446 | 4457 | 1 | 2 | 3 | 4 | 5  | 6  | 7  | 8  | 9  |
| 65 | 4467 | 4477 | 4487 | 4498 | 4508 | 4519 | 4529 | 4539 | 4550 | 4560 | 1 | 2 | 3 | 4 | 5  | 6  | 7  | 8  | 9  |
| 66 | 4571 | 4581 | 4592 | 4603 | 4613 | 4624 | 4634 | 4645 | 4656 | 4667 | 1 | 2 | 3 | 4 | 5  | 6  | 7  | 9  | 10 |
| 67 | 4677 | 4688 | 4699 | 4710 | 4721 | 4732 | 4742 | 4753 | 4764 | 4775 | 1 | 2 | 3 | 4 | 5  | 7  | 8  | 9  | 10 |
| 68 | 4786 | 4797 | 4808 | 4819 | 4831 | 4842 | 4853 | 4864 | 4875 | 4887 | 1 | 2 | 3 | 4 | 6  | 7  | 8  | 9  | 10 |
| 69 | 4898 | 4909 | 4920 | 4932 | 4943 | 4955 | 4966 | 4977 | 4989 | 5000 | 1 | 2 | 3 | 5 | 6  | 7  | 8  | 9  | 10 |
| 70 | 5012 | 5023 | 5035 | 5047 | 5058 | 5070 | 5082 | 5093 | 5105 | 5117 | 1 | 2 | 4 | 5 | 6  | 7  | 8  | 9  | 11 |
| 71 | 5129 | 5140 | 5152 | 5164 | 5176 | 5188 | 5200 | 5212 | 5224 | 5236 | 1 | 2 | 4 | 5 | 6  | 7  | 8  | 10 | 11 |
| 72 | 5248 | 5260 | 5272 | 5284 | 5297 | 5309 | 5321 | 5333 | 5346 | 5358 | 1 | 2 | 4 | 5 | 6  | 7  | 9  | 10 | 11 |
| 73 | 5370 | 5383 | 5395 | 5408 | 5420 | 5433 | 5445 | 5458 | 5470 | 5483 | 1 | 3 | 4 | 5 | 6  | 8  | 9  | 10 | 11 |
| 74 | 5495 | 5508 | 5521 | 5534 | 5546 | 5559 | 5572 | 5585 | 5598 | 5610 | 1 | 3 | 4 | 5 | 6  | 8  | 9  | 10 | 12 |
| 75 | 5623 | 5636 | 5649 | 5662 | 5675 | 5689 | 5702 | 5715 | 5728 | 5741 | 1 | 3 | 4 | 5 | 7  | 8  | 9  | 10 | 12 |
| 76 | 5754 | 5768 | 5781 | 5794 | 5808 | 5821 | 5834 | 5848 | 5861 | 5875 | 1 | 3 | 4 | 5 | 7  | 8  | 9  | 11 | 12 |
| 77 | 5888 | 5902 | 5916 | 5929 | 5943 | 5957 | 5970 | 5984 | 5998 | 6012 | 1 | 3 | 4 | 5 | 7  | 8  | 10 | 11 | 12 |
| 78 | 6026 | 6039 | 6053 | 6067 | 6081 | 6095 | 6109 | 6124 | 6138 | 6152 | 1 | 3 | 4 | 6 | 7  | 8  | 10 | 11 | 13 |
| 79 | 6166 | 6180 | 6194 | 6209 | 6223 | 6237 | 6252 | 6266 | 6281 | 6295 | 1 | 3 | 4 | 6 | 7  | 9  | 10 | 11 | 13 |
| 80 | 6310 | 6324 | 6339 | 6353 | 6368 | 6383 | 6397 | 6412 | 6427 | 6442 | 1 | 3 | 4 | 6 | 7  | 9  | 10 | 12 | 13 |
| 81 | 6457 | 6471 | 6486 | 6501 | 6516 | 6531 | 6546 | 6561 | 6577 | 6592 | 2 | 3 | 5 | 6 | 8  | 9  | 11 | 12 | 14 |
| 82 | 6607 | 6622 | 6637 | 6653 | 6668 | 6683 | 6699 | 6714 | 6730 | 6745 | 2 | 3 | 5 | 6 | 8  | 9  | 11 | 12 | 14 |
| 83 | 6761 | 6776 | 6792 | 6808 | 6823 | 6839 | 6855 | 6871 | 6887 | 6902 | 2 | 3 | 5 | 6 | 8  | 9  | 11 | 13 | 14 |
| 84 | 6918 | 6934 | 6950 | 6966 | 6982 | 6998 | 7015 | 7031 | 7047 | 7063 | 2 | 3 | 5 | 6 | 8  | 10 | 11 | 13 | 15 |
| 85 | 7079 | 7096 | 7112 | 7129 | 7145 | 7161 | 7178 | 7194 | 7211 | 7228 | 2 | 3 | 5 | 7 | 8  | 10 | 12 | 13 | 15 |
| 86 | 7244 | 7261 | 7278 | 7295 | 7311 | 7328 | 7345 | 7362 | 7379 | 7396 | 2 | 3 | 5 | 7 | 8  | 10 | 12 | 13 | 15 |
| 87 | 7413 | 7430 | 7447 | 7464 | 7482 | 7499 | 7516 | 7534 | 7551 | 7568 | 2 | 3 | 5 | 7 | 9  | 10 | 12 | 14 | 16 |
| 88 | 7586 | 7603 | 7621 | 7638 | 7656 | 7674 | 7691 | 7709 | 7727 | 7745 | 2 | 4 | 5 | 7 | 9  | 11 | 12 | 14 | 16 |
| 89 | 7762 | 7780 | 7798 | 7816 | 7834 | 7852 | 7870 | 7889 | 7907 | 7925 | 2 | 4 | 5 | 7 | 9  | 11 | 13 | 14 | 16 |
| 90 | 7943 | 7962 | 7980 | 7998 | 8017 | 8035 | 8054 | 8072 | 8091 | 8110 | 2 | 4 | 6 | 7 | 9  | 11 | 13 | 15 | 17 |
| 91 | 8128 | 8147 | 8166 | 8185 | 8204 | 8222 | 8241 | 8260 | 8279 | 8299 | 2 | 4 | 6 | 8 | 9  | 11 | 13 | 15 | 17 |
| 92 | 8318 | 8337 | 8356 | 8375 | 8395 | 8414 | 8433 | 8453 | 8472 | 8492 | 2 | 4 | 6 | 8 | 10 | 12 | 14 | 15 | 17 |
| 93 | 8511 | 8531 | 8551 | 8570 | 8590 | 8610 | 8630 | 8650 | 8670 | 8690 | 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 |
| 94 | 8710 | 8730 | 8750 | 8770 | 8790 | 8810 | 8831 | 8851 | 8872 | 8892 | 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 |
| 95 | 8913 | 8933 | 8954 | 8974 | 8995 | 9016 | 9036 | 9057 | 9078 | 9099 | 2 | 4 | 6 | 8 | 10 | 12 | 15 | 17 | 19 |
| 96 | 9120 | 9141 | 9162 | 9183 | 9204 | 9226 | 9247 | 9268 | 9290 | 9311 | 2 | 4 | 6 | 8 | 11 | 13 | 15 | 17 | 19 |
| 97 | 9333 | 9354 | 9376 | 9397 | 9419 | 9441 | 9462 | 9484 | 9506 | 9528 | 2 | 4 | 7 | 9 | 11 | 13 | 15 | 17 | 20 |
| 98 | 9550 | 9572 | 9594 | 9616 | 9638 | 9661 | 9683 | 9705 | 9727 | 9750 | 2 | 4 | 7 | 9 | 11 | 13 | 16 | 18 | 20 |
| 99 | 9772 | 9795 | 9817 | 9840 | 9863 | 9886 | 9908 | 9931 | 9954 | 9977 | 2 | 5 | 7 | 9 | 11 | 14 | 16 | 18 | 20 |

## LOGARITHMIC SINES.

|    | 0'        | 6'     | 12'  | 18'  | 24'  | 30'  | 36'  | 42'  | 48'  | 54'  | 1  | 2  | 3  | 4  | 5   |
|----|-----------|--------|------|------|------|------|------|------|------|------|----|----|----|----|-----|
| 0° | Inf. Neg. | 7'2419 | 5429 | 7190 | 8439 | 9403 | 0200 | 0870 | 1450 | 1961 |    |    |    |    |     |
| 1  | 8'2419    | 2832   | 3210 | 3558 | 3880 | 4179 | 4459 | 4723 | 4971 | 5206 |    |    |    |    |     |
| 2  | 8'5428    | 5640   | 5842 | 6035 | 6220 | 6397 | 6567 | 6731 | 6889 | 7041 |    |    |    |    |     |
| 3  | 8'7188    | 7330   | 7468 | 7602 | 7731 | 7857 | 7979 | 8098 | 8213 | 8326 | 21 | 41 | 62 | 82 | 103 |
| 4  | 8'8436    | 8543   | 8647 | 8749 | 8849 | 8946 | 9042 | 9135 | 9226 | 9315 | 16 | 32 | 48 | 64 | 80  |
| 5  | 8'9403    | 9489   | 9573 | 9655 | 9736 | 9816 | 9894 | 9970 | 0046 | 0120 | 13 | 26 | 39 | 52 | 65  |
| 6  | 9'0192    | 0264   | 0334 | 0403 | 0472 | 0539 | 0605 | 0670 | 0734 | 0797 | 11 | 22 | 33 | 44 | 55  |
| 7  | 9'0859    | 0920   | 0981 | 1040 | 1099 | 1157 | 1214 | 1271 | 1326 | 1381 | 10 | 19 | 29 | 38 | 48  |
| 8  | 9'1436    | 1489   | 1542 | 1594 | 1646 | 1697 | 1747 | 1797 | 1847 | 1895 | 8  | 17 | 25 | 34 | 42  |
| 9  | 9'1943    | 1991   | 2038 | 2085 | 2131 | 2176 | 2221 | 2266 | 2310 | 2353 | 8  | 15 | 23 | 30 | 38  |
| 10 | 9'2397    | 2439   | 2482 | 2524 | 2565 | 2606 | 2647 | 2687 | 2727 | 2767 | 7  | 14 | 20 | 27 | 34  |
| 11 | 9'2806    | 2845   | 2883 | 2921 | 2959 | 2997 | 3034 | 3070 | 3107 | 3143 | 6  | 12 | 19 | 25 | 31  |
| 12 | 9'3179    | 3214   | 3250 | 3284 | 3319 | 3353 | 3387 | 3421 | 3455 | 3488 | 6  | 11 | 17 | 23 | 28  |
| 13 | 9'3521    | 3554   | 3586 | 3618 | 3650 | 3682 | 3713 | 3745 | 3775 | 3806 | 5  | 11 | 16 | 21 | 26  |
| 14 | 9'3837    | 3867   | 3897 | 3927 | 3957 | 3986 | 4015 | 4044 | 4073 | 4102 | 5  | 10 | 15 | 20 | 24  |
| 15 | 9'4130    | 4158   | 4186 | 4214 | 4242 | 4269 | 4296 | 4323 | 4350 | 4377 | 5  | 9  | 14 | 18 | 23  |
| 16 | 9'4403    | 4430   | 4456 | 4482 | 4508 | 4533 | 4559 | 4584 | 4609 | 4634 | 4  | 9  | 13 | 17 | 21  |
| 17 | 9'4659    | 4684   | 4709 | 4733 | 4757 | 4781 | 4805 | 4829 | 4853 | 4876 | 4  | 8  | 12 | 16 | 20  |
| 18 | 9'4900    | 4923   | 4946 | 4969 | 4992 | 5015 | 5037 | 5060 | 5082 | 5104 | 4  | 8  | 11 | 15 | 19  |
| 19 | 9'5126    | 5148   | 5170 | 5192 | 5213 | 5235 | 5256 | 5278 | 5299 | 5320 | 4  | 7  | 11 | 14 | 18  |
| 20 | 9'5341    | 5361   | 5382 | 5402 | 5423 | 5443 | 5463 | 5484 | 5504 | 5523 | 3  | 7  | 10 | 14 | 17  |
| 21 | 9'5543    | 5563   | 5583 | 5602 | 5621 | 5641 | 5660 | 5679 | 5698 | 5717 | 3  | 6  | 10 | 13 | 16  |
| 22 | 9'5736    | 5754   | 5773 | 5792 | 5810 | 5828 | 5847 | 5865 | 5883 | 5901 | 3  | 6  | 9  | 12 | 15  |
| 23 | 9'5919    | 5937   | 5954 | 5972 | 5990 | 6007 | 6024 | 6042 | 6059 | 6076 | 3  | 6  | 9  | 12 | 15  |
| 24 | 9'6093    | 6110   | 6127 | 6144 | 6161 | 6177 | 6194 | 6210 | 6227 | 6243 | 3  | 6  | 8  | 11 | 14  |
| 25 | 9'6259    | 6276   | 6292 | 6308 | 6324 | 6340 | 6356 | 6371 | 6387 | 6403 | 3  | 5  | 8  | 11 | 13  |
| 26 | 9'6418    | 6434   | 6449 | 6465 | 6480 | 6495 | 6510 | 6526 | 6541 | 6556 | 3  | 5  | 8  | 10 | 13  |
| 27 | 9'6570    | 6585   | 6600 | 6615 | 6629 | 6644 | 6659 | 6673 | 6687 | 6702 | 2  | 5  | 7  | 10 | 12  |
| 28 | 9'6716    | 6730   | 6744 | 6759 | 6773 | 6787 | 6801 | 6814 | 6828 | 6842 | 2  | 5  | 7  | 9  | 12  |
| 29 | 9'6856    | 6869   | 6883 | 6896 | 6910 | 6923 | 6937 | 6950 | 6963 | 6977 | 2  | 4  | 7  | 9  | 11  |
| 30 | 9'6990    | 7003   | 7016 | 7029 | 7042 | 7055 | 7068 | 7080 | 7093 | 7106 | 2  | 4  | 6  | 9  | 11  |
| 31 | 9'7118    | 7131   | 7144 | 7156 | 7168 | 7181 | 7193 | 7205 | 7218 | 7230 | 2  | 4  | 6  | 8  | 10  |
| 32 | 9'7242    | 7254   | 7266 | 7278 | 7290 | 7302 | 7314 | 7326 | 7338 | 7349 | 2  | 4  | 6  | 8  | 10  |
| 33 | 9'7361    | 7373   | 7384 | 7396 | 7407 | 7419 | 7430 | 7442 | 7453 | 7464 | 2  | 4  | 6  | 8  | 10  |
| 34 | 9'7476    | 7487   | 7498 | 7509 | 7520 | 7531 | 7542 | 7553 | 7564 | 7575 | 2  | 4  | 6  | 7  | 9   |
| 35 | 9'7586    | 7597   | 7607 | 7618 | 7629 | 7640 | 7650 | 7661 | 7671 | 7682 | 2  | 4  | 5  | 7  | 9   |
| 36 | 9'7692    | 7703   | 7713 | 7723 | 7734 | 7744 | 7754 | 7764 | 7774 | 7785 | 2  | 3  | 5  | 7  | 9   |
| 37 | 9'7795    | 7805   | 7815 | 7825 | 7835 | 7844 | 7854 | 7864 | 7874 | 7884 | 2  | 3  | 5  | 7  | 8   |
| 38 | 9'7893    | 7903   | 7913 | 7922 | 7932 | 7941 | 7951 | 7960 | 7970 | 7979 | 2  | 3  | 5  | 6  | 8   |
| 39 | 9'7989    | 7998   | 8007 | 8017 | 8026 | 8035 | 8044 | 8053 | 8063 | 8072 | 2  | 3  | 5  | 6  | 8   |
| 40 | 9'8081    | 8090   | 8099 | 8108 | 8117 | 8125 | 8134 | 8143 | 8152 | 8161 | 1  | 3  | 4  | 6  | 7   |
| 41 | 9'8169    | 8178   | 8187 | 8195 | 8204 | 8213 | 8221 | 8230 | 8238 | 8247 | 1  | 3  | 4  | 6  | 7   |
| 42 | 9'8255    | 8264   | 8272 | 8280 | 8289 | 8297 | 8305 | 8313 | 8322 | 8330 | 1  | 3  | 4  | 6  | 7   |
| 43 | 9'8338    | 8346   | 8354 | 8362 | 8370 | 8378 | 8386 | 8394 | 8402 | 8410 | 1  | 3  | 4  | 5  | 7   |
| 44 | 9'8418    | 8426   | 8433 | 8441 | 8449 | 8457 | 8464 | 8472 | 8480 | 8487 | 1  | 3  | 4  | 5  | 6   |



# LOGARITHMIC SINES.

21

|     | O'     | 6'   | 12'  | 18'  | 24'  | 30'  | 36'  | 42'  | 48'  | 54'  | 1 | 2 | 3 | 4 | 5 | 6 |
|-----|--------|------|------|------|------|------|------|------|------|------|---|---|---|---|---|---|
| 45° | 9.8495 | 8502 | 8510 | 8517 | 8525 | 8532 | 8540 | 8547 | 8555 | 8562 | I | 2 | 4 |   | 5 | 6 |
| 46  | 9.8569 | 8577 | 8584 | 8591 | 8598 | 8606 | 8613 | 8620 | 8627 | 8634 | I | 2 | 4 |   | 5 | 6 |
| 47  | 9.8641 | 8648 | 8655 | 8662 | 8669 | 8676 | 8683 | 8690 | 8697 | 8704 | I | 2 | 3 |   | 5 | 6 |
| 48  | 9.8711 | 8718 | 8724 | 8731 | 8738 | 8745 | 8751 | 8758 | 8765 | 8771 | I | 2 | 3 |   | 4 | 6 |
| 49  | 9.8778 | 8784 | 8791 | 8797 | 8804 | 8810 | 8817 | 8823 | 8830 | 8836 | I | 2 | 3 |   | 4 | 5 |
| 50  | 9.8843 | 8849 | 8855 | 8862 | 8868 | 8874 | 8880 | 8887 | 8893 | 8899 | I | 2 | 3 |   | 4 | 5 |
| 51  | 9.8905 | 8911 | 8917 | 8923 | 8929 | 8935 | 8941 | 8947 | 8953 | 8959 | I | 2 | 3 |   | 4 | 5 |
| 52  | 9.8965 | 8971 | 8977 | 8983 | 8989 | 8995 | 9000 | 9006 | 9012 | 9018 | I | 2 | 3 |   | 4 | 5 |
| 53  | 9.9023 | 9029 | 9035 | 9041 | 9046 | 9052 | 9057 | 9063 | 9069 | 9074 | I | 2 | 3 |   | 4 | 5 |
| 54  | 9.9080 | 9085 | 9091 | 9096 | 9101 | 9107 | 9112 | 9118 | 9123 | 9128 | I | 2 | 3 |   | 4 | 5 |
| 55  | 9.9134 | 9139 | 9144 | 9149 | 9155 | 9160 | 9165 | 9170 | 9175 | 9181 | I | 2 | 3 |   | 3 | 4 |
| 56  | 9.9186 | 9191 | 9196 | 9201 | 9206 | 9211 | 9216 | 9221 | 9226 | 9231 | I | 2 | 3 |   | 3 | 4 |
| 57  | 9.9236 | 9241 | 9246 | 9251 | 9255 | 9260 | 9265 | 9270 | 9275 | 9279 | I | 2 | 2 |   | 3 | 4 |
| 58  | 9.9284 | 9289 | 9294 | 9298 | 9303 | 9308 | 9312 | 9317 | 9322 | 9326 | I | 2 | 2 |   | 3 | 4 |
| 59  | 9.9331 | 9335 | 9340 | 9344 | 9349 | 9353 | 9358 | 9362 | 9367 | 9371 | I | I | 2 |   | 3 | 4 |
| 60  | 9.9375 | 9380 | 9384 | 9388 | 9393 | 9397 | 9401 | 9406 | 9410 | 9414 | I | I | 2 |   | 3 | 4 |
| 61  | 9.9418 | 9422 | 9427 | 9431 | 9435 | 9439 | 9443 | 9447 | 9451 | 9455 | I | I | 2 |   | 3 | 3 |
| 62  | 9.9459 | 9463 | 9467 | 9471 | 9475 | 9479 | 9483 | 9487 | 9491 | 9495 | I | I | 2 |   | 3 | 3 |
| 63  | 9.9499 | 9503 | 9507 | 9510 | 9514 | 9518 | 9522 | 9525 | 9529 | 9533 | I | I | 2 |   | 3 | 3 |
| 64  | 9.9537 | 9540 | 9544 | 9548 | 9551 | 9555 | 9558 | 9562 | 9566 | 9569 | I | I | 2 |   | 2 | 3 |
| 65  | 9.9573 | 9576 | 9580 | 9583 | 9587 | 9590 | 9594 | 9597 | 9601 | 9604 | I | I | 2 |   | 2 | 3 |
| 66  | 9.9607 | 9611 | 9614 | 9617 | 9621 | 9624 | 9627 | 9631 | 9634 | 9637 | I | I | 2 |   | 2 | 3 |
| 67  | 9.9640 | 9643 | 9647 | 9650 | 9653 | 9656 | 9659 | 9662 | 9666 | 9669 | I | I | 2 |   | 2 | 3 |
| 68  | 9.9672 | 9675 | 9678 | 9681 | 9684 | 9687 | 9690 | 9693 | 9696 | 9699 | O | I | I |   | 2 | 2 |
| 69  | 9.9702 | 9704 | 9707 | 9710 | 9713 | 9716 | 9719 | 9722 | 9724 | 9727 | O | I | I |   | 2 | 2 |
| 70  | 9.9730 | 9733 | 9735 | 9738 | 9741 | 9743 | 9746 | 9749 | 9751 | 9754 | O | I | I |   | 2 | 2 |
| 71  | 9.9757 | 9759 | 9762 | 9764 | 9767 | 9770 | 9772 | 9775 | 9777 | 9780 | O | I | I |   | 2 | 2 |
| 72  | 9.9782 | 9785 | 9787 | 9789 | 9792 | 9794 | 9797 | 9799 | 9801 | 9804 | O | I | I |   | 2 | 2 |
| 73  | 9.9806 | 9808 | 9811 | 9813 | 9815 | 9817 | 9820 | 9822 | 9824 | 9826 | O | I | I |   | 2 | 2 |
| 74  | 9.9828 | 9831 | 9833 | 9835 | 9837 | 9839 | 9841 | 9843 | 9845 | 9847 | O | I | I |   | I | 2 |
| 75  | 9.9849 | 9851 | 9853 | 9855 | 9857 | 9859 | 9861 | 9863 | 9865 | 9867 | O | I | I |   | I | 2 |
| 76  | 9.9869 | 9871 | 9873 | 9875 | 9876 | 9878 | 9880 | 9882 | 9884 | 9885 | O | I | I |   | I | 2 |
| 77  | 9.9887 | 9889 | 9891 | 9892 | 9894 | 9896 | 9897 | 9899 | 9901 | 9902 | O | I | I |   | I | I |
| 78  | 9.9904 | 9906 | 9907 | 9909 | 9910 | 9912 | 9913 | 9915 | 9916 | 9918 | O | I | I |   | I | I |
| 79  | 9.9919 | 9921 | 9922 | 9924 | 9925 | 9927 | 9928 | 9929 | 9931 | 9932 | O | O | I |   | I | I |
| 80  | 9.9934 | 9935 | 9936 | 9937 | 9939 | 9940 | 9941 | 9943 | 9944 | 9945 | O | O | I |   | I | I |
| 81  | 9.9946 | 9947 | 9949 | 9950 | 9951 | 9952 | 9953 | 9954 | 9955 | 9956 | O | O | I |   | I | I |
| 82  | 9.9958 | 9959 | 9960 | 9961 | 9962 | 9963 | 9964 | 9965 | 9966 | 9967 | O | O | I |   | I | I |
| 83  | 9.9968 | 9968 | 9969 | 9970 | 9971 | 9972 | 9973 | 9974 | 9975 | 9975 | O | O | O |   | I | I |
| 84  | 9.9976 | 9977 | 9978 | 9978 | 9979 | 9980 | 9981 | 9981 | 9982 | 9983 | O | O | O |   | O | I |
| 85  | 9.9983 | 9984 | 9985 | 9985 | 9986 | 9987 | 9987 | 9988 | 9988 | 9989 | O | O | O |   | O | O |
| 86  | 9.9989 | 9990 | 9990 | 9991 | 9991 | 9992 | 9992 | 9993 | 9993 | 9994 | O | O | O |   | O | O |
| 87  | 9.9994 | 9994 | 9995 | 9995 | 9996 | 9996 | 9996 | 9997 | 9997 | 9997 | O | O | O |   | O | O |
| 88  | 9.9997 | 9998 | 9998 | 9998 | 9998 | 9999 | 9999 | 9999 | 9999 | 9999 | O | O | O |   | O | O |
| 89  | 9.9999 | 9999 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | O | O | O |   | O | O |

## LOGARITHMIC COSINES.

|    | O'      | 6'   | 12'  | 18'  | 24'  | 30'  | 36'  | 42'  | 48'  | 54'    | 1 | 2 | 3 | 4 | 5 |
|----|---------|------|------|------|------|------|------|------|------|--------|---|---|---|---|---|
| 0° | 10'0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 9'9999 | 0 | 0 | 0 | 0 | 0 |
| 1  | 9'9999  | 9999 | 9999 | 9999 | 9999 | 9999 | 9998 | 9998 | 9998 | 9998   | 0 | 0 | 0 | 0 | 0 |
| 2  | 9'9997  | 9997 | 9997 | 9996 | 9996 | 9996 | 9996 | 9995 | 9995 | 9994   | 0 | 0 | 0 | 0 | 0 |
| 3  | 9'9994  | 9994 | 9993 | 9993 | 9992 | 9992 | 9991 | 9991 | 9990 | 9990   | 0 | 0 | 0 | 0 | 0 |
| 4  | 9'9989  | 9989 | 9988 | 9988 | 9987 | 9987 | 9986 | 9985 | 9985 | 9984   | 0 | 0 | 0 | 0 | 0 |
| 5  | 9'9983  | 9983 | 9982 | 9981 | 9981 | 9980 | 9979 | 9978 | 9978 | 9977   | 0 | 0 | 0 | 0 | 1 |
| 6  | 9'9976  | 9975 | 9975 | 9974 | 9973 | 9972 | 9971 | 9970 | 9969 | 9968   | 0 | 0 | 0 | 1 | 1 |
| 7  | 9'9968  | 9967 | 9966 | 9965 | 9964 | 9963 | 9962 | 9961 | 9960 | 9959   | 0 | 0 | 1 | 1 | 1 |
| 8  | 9'9957  | 9956 | 9955 | 9954 | 9953 | 9952 | 9951 | 9950 | 9949 | 9947   | 0 | 0 | 1 | 1 | 1 |
| 9  | 9'9946  | 9945 | 9944 | 9943 | 9941 | 9940 | 9939 | 9937 | 9936 | 9935   | 0 | 0 | 1 | 1 | 1 |
| 10 | 9'9934  | 9932 | 9931 | 9929 | 9928 | 9927 | 9925 | 9924 | 9922 | 9921   | 0 | 0 | 1 | 1 | 1 |
| 11 | 9'9919  | 9918 | 9916 | 9915 | 9913 | 9912 | 9910 | 9909 | 9907 | 9906   | 0 | 1 | 1 | 1 | 1 |
| 12 | 9'9904  | 9902 | 9901 | 9899 | 9897 | 9896 | 9894 | 9892 | 9891 | 9889   | 0 | 1 | 1 | 1 | 1 |
| 13 | 9'9887  | 9885 | 9884 | 9882 | 9880 | 9878 | 9876 | 9875 | 9873 | 9871   | 0 | 1 | 1 | 1 | 2 |
| 14 | 9'9869  | 9867 | 9865 | 9863 | 9861 | 9859 | 9857 | 9855 | 9853 | 9851   | 0 | 1 | 1 | 1 | 2 |
| 15 | 9'9849  | 9847 | 9845 | 9843 | 9841 | 9839 | 9837 | 9835 | 9833 | 9831   | 0 | 1 | 1 | 1 | 2 |
| 16 | 9'9828  | 9826 | 9824 | 9822 | 9820 | 9817 | 9815 | 9813 | 9811 | 9808   | 0 | 1 | 1 | 2 | 2 |
| 17 | 9'9806  | 9804 | 9801 | 9799 | 9797 | 9794 | 9792 | 9789 | 9787 | 9785   | 0 | 1 | 1 | 2 | 2 |
| 18 | 9'9782  | 9780 | 9777 | 9775 | 9772 | 9770 | 9767 | 9764 | 9762 | 9759   | 0 | 1 | 1 | 2 | 2 |
| 19 | 9'9757  | 9754 | 9751 | 9749 | 9746 | 9743 | 9741 | 9738 | 9735 | 9733   | 0 | 1 | 1 | 2 | 2 |
| 20 | 9'9730  | 9727 | 9724 | 9722 | 9719 | 9716 | 9713 | 9710 | 9707 | 9704   | 0 | 1 | 1 | 2 | 2 |
| 21 | 9'9702  | 9699 | 9696 | 9693 | 9690 | 9687 | 9684 | 9681 | 9678 | 9675   | 0 | 1 | 1 | 2 | 2 |
| 22 | 9'9672  | 9669 | 9666 | 9662 | 9659 | 9656 | 9653 | 9650 | 9647 | 9643   | 1 | 1 | 2 | 2 | 3 |
| 23 | 9'9640  | 9637 | 9634 | 9631 | 9627 | 9624 | 9621 | 9617 | 9614 | 9611   | 1 | 1 | 2 | 2 | 3 |
| 24 | 9'9607  | 9604 | 9601 | 9597 | 9594 | 9590 | 9587 | 9583 | 9580 | 9576   | 1 | 1 | 2 | 2 | 3 |
| 25 | 9'9573  | 9569 | 9566 | 9562 | 9558 | 9555 | 9551 | 9548 | 9544 | 9540   | 1 | 1 | 2 | 2 | 3 |
| 26 | 9'9537  | 9533 | 9529 | 9525 | 9522 | 9518 | 9514 | 9510 | 9507 | 9503   | 1 | 1 | 2 | 3 | 3 |
| 27 | 9'9499  | 9495 | 9491 | 9487 | 9483 | 9479 | 9475 | 9471 | 9467 | 9463   | 1 | 1 | 2 | 3 | 3 |
| 28 | 9'9459  | 9455 | 9451 | 9447 | 9443 | 9439 | 9435 | 9431 | 9427 | 9422   | 1 | 1 | 2 | 3 | 3 |
| 29 | 9'9418  | 9414 | 9410 | 9406 | 9401 | 9397 | 9393 | 9388 | 9384 | 9380   | 1 | 1 | 2 | 3 | 4 |
| 30 | 9'9375  | 9371 | 9367 | 9362 | 9358 | 9353 | 9349 | 9344 | 9340 | 9335   | 1 | 1 | 2 | 3 | 4 |
| 31 | 9'9331  | 9326 | 9322 | 9317 | 9312 | 9308 | 9303 | 9298 | 9294 | 9289   | 1 | 2 | 2 | 3 | 4 |
| 32 | 9'9284  | 9279 | 9275 | 9270 | 9265 | 9260 | 9255 | 9251 | 9246 | 9241   | 1 | 2 | 2 | 3 | 4 |
| 33 | 9'9236  | 9231 | 9226 | 9221 | 9216 | 9211 | 9206 | 9201 | 9196 | 9191   | 1 | 2 | 3 | 3 | 4 |
| 34 | 9'9186  | 9181 | 9175 | 9170 | 9165 | 9160 | 9155 | 9149 | 9144 | 9139   | 1 | 2 | 3 | 3 | 4 |
| 35 | 9'9134  | 9128 | 9123 | 9118 | 9112 | 9107 | 9101 | 9096 | 9091 | 9085   | 1 | 2 | 3 | 4 | 5 |
| 36 | 9'9080  | 9074 | 9069 | 9063 | 9057 | 9052 | 9046 | 9041 | 9035 | 9029   | 1 | 2 | 3 | 4 | 5 |
| 37 | 9'9023  | 9018 | 9012 | 9006 | 9000 | 8995 | 8989 | 8983 | 8977 | 8971   | 1 | 2 | 3 | 4 | 5 |
| 38 | 9'8965  | 8959 | 8953 | 8947 | 8941 | 8935 | 8929 | 8923 | 8917 | 8911   | 1 | 2 | 3 | 4 | 5 |
| 39 | 9'8905  | 8899 | 8893 | 8887 | 8880 | 8874 | 8868 | 8862 | 8855 | 8849   | 1 | 2 | 3 | 4 | 5 |
| 40 | 9'8843  | 8836 | 8830 | 8823 | 8817 | 8810 | 8804 | 8797 | 8791 | 8784   | 1 | 2 | 3 | 4 | 5 |
| 41 | 9'8778  | 8771 | 8765 | 8758 | 8751 | 8745 | 8738 | 8731 | 8724 | 8718   | 1 | 2 | 3 | 5 | 6 |
| 42 | 9'8711  | 8704 | 8697 | 8690 | 8683 | 8676 | 8669 | 8662 | 8655 | 8648   | 1 | 2 | 3 | 5 | 6 |
| 43 | 9'8641  | 8634 | 8627 | 8620 | 8613 | 8606 | 8598 | 8591 | 8584 | 8577   | 1 | 2 | 4 | 5 | 6 |
| 44 | 9'8569  | 8562 | 8555 | 8547 | 8540 | 8532 | 8525 | 8517 | 8510 | 8502   | 1 | 2 | 4 | 5 | 6 |

N.B.—Numbers in difference columns to be subtracted, not added.—See Rules.

|     | 0'     | 6'   | 12'  | 18'  | 24'  | 30'    | 36'  | 42'  | 48'  | 54'  | 1  | 2  | 3  | 4 | 5  | 6   |
|-----|--------|------|------|------|------|--------|------|------|------|------|----|----|----|---|----|-----|
| 45° | 9°8495 | 8487 | 8480 | 8472 | 8464 | 8457   | 8449 | 8441 | 8433 | 8426 | 1  | 3  | 4  |   | 5  | 6   |
| 46  | 9°8418 | 8410 | 8402 | 8394 | 8386 | 8378   | 8370 | 8362 | 8354 | 8346 | 1  | 3  | 4  |   | 5  | 7   |
| 47  | 9°8338 | 8330 | 8322 | 8313 | 8305 | 8297   | 8289 | 8280 | 8272 | 8264 | 1  | 3  | 4  |   | 6  | 7   |
| 48  | 9°8255 | 8247 | 8238 | 8230 | 8221 | 8213   | 8204 | 8195 | 8187 | 8178 | 1  | 3  | 4  |   | 6  | 7   |
| 49  | 9°8169 | 8161 | 8152 | 8143 | 8134 | 8125   | 8117 | 8108 | 8099 | 8090 | 1  | 3  | 4  |   | 6  | 7   |
| 50  | 9°8081 | 8072 | 8063 | 8053 | 8044 | 8035   | 8026 | 8017 | 8007 | 7998 | 2  | 3  | 5  |   | 6  | 8   |
| 51  | 9°7989 | 7979 | 7970 | 7960 | 7951 | 7941   | 7932 | 7922 | 7913 | 7903 | 2  | 3  | 5  |   | 6  | 8   |
| 52  | 9°7893 | 7884 | 7874 | 7864 | 7854 | 7844   | 7835 | 7825 | 7815 | 7805 | 2  | 3  | 5  |   | 7  | 8   |
| 53  | 9°7795 | 7785 | 7774 | 7764 | 7754 | 7744   | 7734 | 7723 | 7713 | 7703 | 2  | 3  | 5  |   | 7  | 9   |
| 54  | 9°7692 | 7682 | 7671 | 7661 | 7650 | 7640   | 7629 | 7618 | 7607 | 7597 | 2  | 4  | 5  |   | 7  | 9   |
| 55  | 9°7586 | 7575 | 7564 | 7553 | 7542 | 7531   | 7520 | 7509 | 7498 | 7487 | 2  | 4  | 6  |   | 7  | 9   |
| 56  | 9°7476 | 7464 | 7453 | 7442 | 7430 | 7419   | 7407 | 7396 | 7384 | 7373 | 2  | 4  | 6  |   | 8  | 10  |
| 57  | 9°7361 | 7349 | 7338 | 7326 | 7314 | 7302   | 7290 | 7278 | 7266 | 7254 | 2  | 4  | 6  |   | 8  | 10  |
| 58  | 9°7242 | 7230 | 7218 | 7205 | 7193 | 7181   | 7168 | 7156 | 7144 | 7131 | 2  | 4  | 6  |   | 8  | 10  |
| 59  | 9°7118 | 7106 | 7093 | 7080 | 7068 | 7055   | 7042 | 7029 | 7016 | 7003 | 2  | 4  | 6  |   | 9  | 11  |
| 60  | 9°6990 | 6977 | 6963 | 6950 | 6937 | 6923   | 6910 | 6896 | 6883 | 6869 | 2  | 4  | 7  |   | 9  | 11  |
| 61  | 9°6856 | 6842 | 6828 | 6814 | 6801 | 6787   | 6773 | 6759 | 6744 | 6730 | 2  | 5  | 7  |   | 9  | 12  |
| 62  | 9°6716 | 6702 | 6687 | 6673 | 6659 | 6644   | 6629 | 6615 | 6600 | 6585 | 2  | 5  | 7  |   | 10 | 12  |
| 63  | 9°6570 | 6556 | 6541 | 6526 | 6510 | 6495   | 6480 | 6465 | 6449 | 6434 | 3  | 5  | 8  |   | 10 | 13  |
| 64  | 9°6418 | 6403 | 6387 | 6371 | 6356 | 6340   | 6324 | 6308 | 6292 | 6276 | 3  | 5  | 8  |   | 11 | 13  |
| 65  | 9°6259 | 6243 | 6227 | 6210 | 6194 | 6177   | 6161 | 6144 | 6127 | 6110 | 3  | 6  | 8  |   | 11 | 14  |
| 66  | 9°6093 | 6076 | 6059 | 6042 | 6024 | 6007   | 5990 | 5972 | 5954 | 5937 | 3  | 6  | 9  |   | 12 | 15  |
| 67  | 9°5919 | 5901 | 5883 | 5865 | 5847 | 5828   | 5810 | 5792 | 5773 | 5754 | 3  | 6  | 9  |   | 12 | 15  |
| 68  | 9°5736 | 5717 | 5698 | 5679 | 5660 | 5641   | 5621 | 5602 | 5583 | 5563 | 3  | 6  | 10 |   | 13 | 16  |
| 69  | 9°5543 | 5523 | 5504 | 5484 | 5463 | 5443   | 5423 | 5402 | 5382 | 5361 | 3  | 7  | 10 |   | 14 | 17  |
| 70  | 9°5341 | 5320 | 5299 | 5278 | 5256 | 5235   | 5213 | 5192 | 5170 | 5148 | 4  | 7  | 11 |   | 14 | 18  |
| 71  | 9°5126 | 5104 | 5082 | 5060 | 5037 | 5015   | 4992 | 4969 | 4946 | 4923 | 4  | 8  | 11 |   | 15 | 19  |
| 72  | 9°4900 | 4876 | 4853 | 4829 | 4805 | 4781   | 4757 | 4733 | 4709 | 4684 | 4  | 8  | 12 |   | 16 | 20  |
| 73  | 9°4659 | 4634 | 4609 | 4584 | 4559 | 4533   | 4508 | 4482 | 4456 | 4430 | 4  | 9  | 13 |   | 17 | 21  |
| 74  | 9°4403 | 4377 | 4350 | 4323 | 4296 | 4269   | 4242 | 4214 | 4186 | 4158 | 5  | 9  | 14 |   | 18 | 23  |
| 75  | 9°4130 | 4102 | 4073 | 4044 | 4015 | 3986   | 3957 | 3927 | 3897 | 3867 | 5  | 10 | 15 |   | 20 | 24  |
| 76  | 9°3837 | 3806 | 3775 | 3745 | 3713 | 3682   | 3650 | 3618 | 3586 | 3554 | 5  | 11 | 16 |   | 21 | 26  |
| 77  | 9°3521 | 3488 | 3455 | 3421 | 3387 | 3353   | 3319 | 3284 | 3250 | 3214 | 6  | 11 | 17 |   | 23 | 28  |
| 78  | 9°3179 | 3143 | 3107 | 3070 | 3034 | 2997   | 2959 | 2921 | 2883 | 2845 | 6  | 12 | 19 |   | 25 | 31  |
| 79  | 9°2806 | 2767 | 2727 | 2687 | 2647 | 2606   | 2565 | 2524 | 2482 | 2439 | 7  | 14 | 20 |   | 27 | 34  |
| 80  | 9°2397 | 2353 | 2310 | 2266 | 2221 | 2176   | 2131 | 2085 | 2038 | 1991 | 8  | 15 | 23 |   | 30 | 38  |
| 81  | 9°1943 | 1895 | 1847 | 1797 | 1747 | 1697   | 1646 | 1594 | 1542 | 1489 | 8  | 17 | 25 |   | 34 | 42  |
| 82  | 9°1436 | 1381 | 1326 | 1271 | 1214 | 1157   | 1099 | 1040 | 0981 | 0920 | 10 | 19 | 29 |   | 38 | 48  |
| 83  | 9°0859 | 0797 | 0734 | 0670 | 0605 | 0539   | 0472 | 0403 | 0334 | 0264 | 11 | 22 | 33 |   | 44 | 55  |
| 84  | 9°0192 | 0120 | 0046 | 9970 | 9894 | 9816   | 9736 | 9655 | 9573 | 9489 | 13 | 26 | 39 |   | 52 | 65  |
| 85  | 8°9403 | 9315 | 9226 | 9135 | 9042 | 8946   | 8849 | 8749 | 8647 | 8543 | 16 | 32 | 48 |   | 64 | 80  |
| 86  | 8°8436 | 8326 | 8213 | 8098 | 7979 | 7857   | 7731 | 7602 | 7468 | 7330 | 21 | 41 | 62 |   | 82 | 103 |
| 87  | 8°7188 | 7041 | 6889 | 6731 | 6567 | 6397   | 6220 | 6035 | 5842 | 5640 |    |    |    |   |    |     |
| 88  | 8°5428 | 5206 | 4971 | 4723 | 4459 | 4179   | 3880 | 3558 | 3210 | 2832 |    |    |    |   |    |     |
| 89  | 8°2419 | 1961 | 1450 | 0870 | 0200 | 7°9408 | 8439 | 7190 | 5429 | 2419 |    |    |    |   |    |     |

N.B.—Numbers in difference columns to be subtracted, not added.—See Rules.



## LOGARITHMIC TANGENTS.

|    | O'        | 6'     | 12'  | 18'  | 24'  | 30'  | 36'  | 42'  | 48'  | 54'  | 1 2 3    | 4 5     |
|----|-----------|--------|------|------|------|------|------|------|------|------|----------|---------|
| 0° | Inf. Neg. | 7'2419 | 5429 | 7190 | 8439 | 9409 | 0200 | 0870 | 1450 | 1962 |          |         |
| 1  | 8'2419    | 2833   | 3211 | 3559 | 3881 | 4181 | 4461 | 4725 | 4973 | 5208 |          |         |
| 2  | 8'5431    | 5643   | 5845 | 6038 | 6223 | 6401 | 6571 | 6736 | 6894 | 7046 | 29 58 87 | 116 145 |
| 3  | 8'7194    | 7337   | 7475 | 7609 | 7739 | 7865 | 7988 | 8107 | 8223 | 8336 | 21 41 62 | 83 103  |
| 4  | 8'8446    | 8554   | 8659 | 8762 | 8862 | 8960 | 9056 | 9150 | 9241 | 9331 | 16 32 48 | 64 81   |
| 5  | 8'9420    | 9506   | 9591 | 9674 | 9756 | 9836 | 9915 | 9992 | 0068 | 0143 | 13 26 40 | 53 66   |
| 6  | 9'0216    | 0289   | 0360 | 0430 | 0499 | 0567 | 0633 | 0699 | 0764 | 0828 | 11 22 34 | 45 56   |
| 7  | 9'0891    | 0954   | 1015 | 1076 | 1135 | 1194 | 1252 | 1310 | 1367 | 1423 | 10 20 29 | 39 49   |
| 8  | 9'1478    | 1533   | 1587 | 1640 | 1693 | 1745 | 1797 | 1848 | 1898 | 1948 | 9 17 26  | 35 43   |
| 9  | 9'1997    | 2046   | 2094 | 2142 | 2189 | 2236 | 2282 | 2328 | 2374 | 2419 | 8 16 23  | 31 39   |
| 10 | 9'2463    | 2507   | 2551 | 2594 | 2637 | 2680 | 2722 | 2764 | 2805 | 2846 | 7 14 21  | 28 35   |
| 11 | 9'2887    | 2927   | 2967 | 3006 | 3046 | 3085 | 3123 | 3162 | 3200 | 3237 | 6 13 19  | 26 32   |
| 12 | 9'3275    | 3312   | 3349 | 3385 | 3422 | 3458 | 3493 | 3529 | 3564 | 3599 | 6 12 18  | 24 30   |
| 13 | 9'3634    | 3668   | 3702 | 3736 | 3770 | 3804 | 3837 | 3870 | 3903 | 3935 | 6 11 17  | 22 28   |
| 14 | 9'3968    | 4000   | 4032 | 4064 | 4095 | 4127 | 4158 | 4189 | 4220 | 4250 | 5 10 16  | 21 26   |
| 15 | 9'4281    | 4311   | 4341 | 4371 | 4400 | 4430 | 4459 | 4488 | 4517 | 4546 | 5 10 15  | 20 25   |
| 16 | 9'4575    | 4603   | 4632 | 4660 | 4688 | 4716 | 4744 | 4771 | 4799 | 4826 | 5 9 14   | 19 23   |
| 17 | 9'4853    | 4880   | 4907 | 4934 | 4961 | 4987 | 5014 | 5040 | 5066 | 5092 | 4 9 13   | 18 22   |
| 18 | 9'5118    | 5143   | 5169 | 5195 | 5220 | 5245 | 5270 | 5295 | 5320 | 5345 | 4 8 13   | 17 21   |
| 19 | 9'5370    | 5394   | 5419 | 5443 | 5467 | 5491 | 5516 | 5539 | 5563 | 5587 | 4 8 12   | 16 20   |
| 20 | 9'5611    | 5634   | 5658 | 5681 | 5704 | 5727 | 5750 | 5773 | 5796 | 5819 | 4 8 12   | 15 19   |
| 21 | 9'5842    | 5864   | 5887 | 5909 | 5932 | 5954 | 5976 | 5998 | 6020 | 6042 | 4 7 11   | 15 19   |
| 22 | 9'6064    | 6086   | 6108 | 6129 | 6151 | 6172 | 6194 | 6215 | 6236 | 6257 | 4 7 11   | 14 18   |
| 23 | 9'6279    | 6300   | 6321 | 6341 | 6362 | 6383 | 6404 | 6424 | 6445 | 6465 | 3 7 10   | 14 17   |
| 24 | 9'6486    | 6506   | 6527 | 6547 | 6567 | 6587 | 6607 | 6627 | 6647 | 6667 | 3 7 10   | 13 17   |
| 25 | 9'6687    | 6706   | 6726 | 6746 | 6765 | 6785 | 6804 | 6824 | 6843 | 6863 | 3 7 10   | 13 16   |
| 26 | 9'6882    | 6901   | 6920 | 6939 | 6958 | 6977 | 6996 | 7015 | 7034 | 7053 | 3 6 9    | 13 16   |
| 27 | 9'7072    | 7090   | 7109 | 7128 | 7146 | 7165 | 7183 | 7202 | 7220 | 7238 | 3 6 9    | 12 15   |
| 28 | 9'7257    | 7275   | 7293 | 7311 | 7330 | 7348 | 7366 | 7384 | 7402 | 7420 | 3 6 9    | 12 15   |
| 29 | 9'7438    | 7455   | 7473 | 7491 | 7509 | 7526 | 7544 | 7562 | 7579 | 7597 | 3 6 9    | 12 15   |
| 30 | 9'7614    | 7632   | 7649 | 7667 | 7684 | 7701 | 7719 | 7736 | 7753 | 7771 | 3 6 9    | 12 14   |
| 31 | 9'7788    | 7805   | 7822 | 7839 | 7856 | 7873 | 7890 | 7907 | 7924 | 7941 | 3 6 9    | 11 14   |
| 32 | 9'7958    | 7975   | 7992 | 8008 | 8025 | 8042 | 8059 | 8075 | 8092 | 8109 | 3 6 8    | 11 14   |
| 33 | 9'8125    | 8142   | 8158 | 8175 | 8191 | 8208 | 8224 | 8241 | 8257 | 8274 | 3 5 8    | 11 14   |
| 34 | 9'8290    | 8306   | 8323 | 8339 | 8355 | 8371 | 8388 | 8404 | 8420 | 8436 | 3 5 8    | 11 14   |
| 35 | 9'8452    | 8468   | 8484 | 8501 | 8517 | 8533 | 8549 | 8565 | 8581 | 8597 | 3 5 8    | 11 13   |
| 36 | 9'8613    | 8629   | 8644 | 8660 | 8676 | 8692 | 8708 | 8724 | 8740 | 8755 | 3 5 8    | 11 13   |
| 37 | 9'8771    | 8787   | 8803 | 8818 | 8834 | 8850 | 8865 | 8881 | 8897 | 8912 | 3 5 8    | 10 13   |
| 38 | 9'8928    | 8944   | 8959 | 8975 | 8990 | 9006 | 9022 | 9037 | 9053 | 9068 | 3 5 8    | 10 13   |
| 39 | 9'9084    | 9099   | 9115 | 9130 | 9146 | 9161 | 9176 | 9192 | 9207 | 9223 | 3 5 8    | 10 13   |
| 40 | 9'9238    | 9254   | 9269 | 9284 | 9300 | 9315 | 9330 | 9346 | 9361 | 9376 | 3 5 8    | 10 13   |
| 41 | 9'9392    | 9407   | 9422 | 9438 | 9453 | 9468 | 9483 | 9499 | 9514 | 9529 | 3 5 8    | 10 13   |
| 42 | 9'9544    | 9560   | 9575 | 9590 | 9605 | 9621 | 9636 | 9651 | 9666 | 9681 | 3 5 8    | 10 13   |
| 43 | 9'9697    | 9712   | 9727 | 9742 | 9757 | 9773 | 9788 | 9803 | 9818 | 9833 | 3 5 8    | 10 13   |
| 44 | 9'9848    | 9864   | 9879 | 9894 | 9909 | 9924 | 9939 | 9955 | 9970 | 9985 | 3 5 8    | 10 13   |

# LOGARITHMIC TANGENTS.

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|     | 0'      | 6'   | 12'  | 18'  | 24'  | 30'  | 36'  | 42'  | 48'  | 54'  | 1  | 2  | 3  | 4   | 5   |
|-----|---------|------|------|------|------|------|------|------|------|------|----|----|----|-----|-----|
| 45° | 10°0000 | 0015 | 0030 | 0045 | 0061 | 0076 | 0091 | 0106 | 0121 | 0136 | 3  | 5  | 8  | 10  | 13  |
| 46  | 10°0152 | 0167 | 0182 | 0197 | 0212 | 0228 | 0243 | 0258 | 0273 | 0288 | 3  | 5  | 8  | 10  | 13  |
| 47  | 10°0303 | 0319 | 0334 | 0349 | 0364 | 0379 | 0395 | 0410 | 0425 | 0440 | 3  | 5  | 8  | 10  | 13  |
| 48  | 10°0456 | 0471 | 0486 | 0501 | 0517 | 0532 | 0547 | 0562 | 0578 | 0593 | 3  | 5  | 8  | 10  | 13  |
| 49  | 10°0608 | 0624 | 0639 | 0654 | 0670 | 0685 | 0700 | 0716 | 0731 | 0746 | 3  | 5  | 8  | 10  | 13  |
| 50  | 10°0762 | 0777 | 0793 | 0808 | 0824 | 0839 | 0854 | 0870 | 0885 | 0901 | 3  | 5  | 8  | 10  | 13  |
| 51  | 10°0916 | 0932 | 0947 | 0963 | 0978 | 0994 | 1010 | 1025 | 1041 | 1056 | 3  | 5  | 8  | 10  | 13  |
| 52  | 10°1072 | 1088 | 1103 | 1119 | 1135 | 1150 | 1166 | 1182 | 1197 | 1213 | 3  | 5  | 8  | 10  | 13  |
| 53  | 10°1229 | 1245 | 1260 | 1276 | 1292 | 1308 | 1324 | 1340 | 1356 | 1371 | 3  | 5  | 8  | 11  | 13  |
| 54  | 10°1387 | 1403 | 1419 | 1435 | 1451 | 1467 | 1483 | 1499 | 1516 | 1532 | 3  | 5  | 8  | 11  | 13  |
| 55  | 10°1548 | 1564 | 1580 | 1596 | 1612 | 1629 | 1645 | 1661 | 1677 | 1694 | 3  | 5  | 8  | 11  | 14  |
| 56  | 10°1710 | 1726 | 1743 | 1759 | 1776 | 1792 | 1809 | 1825 | 1842 | 1858 | 3  | 5  | 8  | 11  | 14  |
| 57  | 10°1875 | 1891 | 1908 | 1925 | 1941 | 1958 | 1975 | 1992 | 2008 | 2025 | 3  | 6  | 8  | 11  | 14  |
| 58  | 10°2042 | 2059 | 2076 | 2093 | 2110 | 2127 | 2144 | 2161 | 2178 | 2195 | 3  | 6  | 9  | 11  | 14  |
| 59  | 10°2212 | 2229 | 2247 | 2264 | 2281 | 2299 | 2316 | 2333 | 2351 | 2368 | 3  | 6  | 9  | 12  | 14  |
| 60  | 10°2386 | 2403 | 2421 | 2438 | 2456 | 2474 | 2491 | 2509 | 2527 | 2545 | 3  | 6  | 9  | 12  | 15  |
| 61  | 10°2562 | 2580 | 2598 | 2616 | 2634 | 2652 | 2670 | 2689 | 2707 | 2725 | 3  | 6  | 9  | 12  | 15  |
| 62  | 10°2743 | 2762 | 2780 | 2798 | 2817 | 2835 | 2854 | 2872 | 2891 | 2910 | 3  | 6  | 9  | 12  | 15  |
| 63  | 10°2928 | 2947 | 2966 | 2985 | 3004 | 3023 | 3042 | 3061 | 3080 | 3099 | 3  | 6  | 9  | 13  | 16  |
| 64  | 10°3118 | 3137 | 3157 | 3176 | 3196 | 3215 | 3235 | 3254 | 3274 | 3294 | 3  | 6  | 10 | 13  | 16  |
| 65  | 10°3313 | 3333 | 3353 | 3373 | 3393 | 3413 | 3433 | 3453 | 3473 | 3494 | 3  | 7  | 10 | 13  | 17  |
| 66  | 10°3514 | 3535 | 3555 | 3576 | 3596 | 3617 | 3638 | 3659 | 3679 | 3700 | 3  | 7  | 10 | 14  | 17  |
| 67  | 10°3721 | 3743 | 3764 | 3785 | 3806 | 3828 | 3849 | 3871 | 3892 | 3914 | 4  | 7  | 11 | 14  | 18  |
| 68  | 10°3936 | 3958 | 3980 | 4002 | 4024 | 4046 | 4068 | 4091 | 4113 | 4136 | 4  | 7  | 11 | 15  | 19  |
| 69  | 10°4158 | 4181 | 4204 | 4227 | 4250 | 4273 | 4296 | 4319 | 4342 | 4366 | 4  | 8  | 12 | 15  | 19  |
| 70  | 10°4389 | 4413 | 4437 | 4461 | 4484 | 4509 | 4533 | 4557 | 4581 | 4606 | 4  | 8  | 12 | 16  | 20  |
| 71  | 10°4630 | 4655 | 4680 | 4705 | 4730 | 4755 | 4780 | 4805 | 4831 | 4857 | 4  | 8  | 13 | 17  | 21  |
| 72  | 10°4882 | 4908 | 4934 | 4960 | 4986 | 5013 | 5039 | 5066 | 5093 | 5120 | 4  | 9  | 13 | 18  | 22  |
| 73  | 10°5147 | 5174 | 5201 | 5229 | 5256 | 5284 | 5312 | 5340 | 5368 | 5397 | 5  | 9  | 14 | 19  | 23  |
| 74  | 10°5425 | 5454 | 5483 | 5512 | 5541 | 5570 | 5600 | 5629 | 5659 | 5689 | 5  | 10 | 15 | 20  | 25  |
| 75  | 10°5719 | 5750 | 5780 | 5811 | 5842 | 5873 | 5905 | 5936 | 5968 | 6000 | 5  | 10 | 16 | 21  | 26  |
| 76  | 10°6032 | 6065 | 6097 | 6130 | 6163 | 6196 | 6230 | 6264 | 6298 | 6332 | 6  | 11 | 17 | 22  | 28  |
| 77  | 10°6366 | 6401 | 6436 | 6471 | 6507 | 6542 | 6578 | 6615 | 6651 | 6688 | 6  | 12 | 18 | 24  | 30  |
| 78  | 10°6725 | 6763 | 6800 | 6838 | 6877 | 6915 | 6954 | 6994 | 7033 | 7073 | 6  | 13 | 19 | 26  | 32  |
| 79  | 10°7113 | 7154 | 7195 | 7236 | 7278 | 7320 | 7363 | 7406 | 7449 | 7493 | 7  | 14 | 21 | 28  | 35  |
| 80  | 10°7537 | 7581 | 7626 | 7672 | 7718 | 7764 | 7811 | 7858 | 7906 | 7954 | 8  | 16 | 23 | 31  | 39  |
| 81  | 10°8003 | 8052 | 8102 | 8152 | 8203 | 8255 | 8307 | 8360 | 8413 | 8467 | 9  | 17 | 26 | 35  | 43  |
| 82  | 10°8522 | 8577 | 8633 | 8690 | 8748 | 8806 | 8865 | 8924 | 8985 | 9046 | 10 | 20 | 29 | 39  | 49  |
| 83  | 10°9109 | 9172 | 9236 | 9301 | 9367 | 9433 | 9501 | 9570 | 9640 | 9711 | 11 | 22 | 34 | 45  | 56  |
| 84  | 10°9784 | 9857 | 9932 | 0008 | 0085 | 0164 | 0244 | 0326 | 0409 | 0494 | 13 | 26 | 40 | 53  | 66  |
| 85  | 11°0580 | 0669 | 0759 | 0850 | 0944 | 1040 | 1138 | 1238 | 1341 | 1446 | 16 | 32 | 48 | 64  | 81  |
| 86  | 11°1554 | 1664 | 1777 | 1893 | 2012 | 2135 | 2261 | 2391 | 2525 | 2663 | 20 | 41 | 62 | 83  | 103 |
| 87  | 11°2806 | 2954 | 3106 | 3264 | 3429 | 3599 | 3777 | 3962 | 4155 | 4357 | 29 | 58 | 87 | 116 | 144 |
| 88  | 11°4569 | 4792 | 5027 | 5275 | 5539 | 5819 | 6119 | 6441 | 6789 | 7167 |    |    |    |     |     |
| 89  | 11°7581 | 8038 | 8550 | 9130 | 9800 | 0591 | 1561 | 2810 | 4571 | 7581 |    |    |    |     |     |

|    | O'      | 6'    | 12'  | 18'  | 24'  | 30'  | 36'  | 42'  | 48'  | 54'  | 1  | 2  | 3  | 4   | 5   |
|----|---------|-------|------|------|------|------|------|------|------|------|----|----|----|-----|-----|
| 0° | Inf.    | 12.76 | 4571 | 2810 | 1561 | 0591 | 9800 | 9130 | 8550 | 8038 |    |    |    |     |     |
| 1  | 11.7581 | 7167  | 6789 | 6441 | 6119 | 5819 | 5539 | 5275 | 5027 | 4792 |    |    |    |     |     |
| 2  | 11.4569 | 4357  | 4155 | 3962 | 3777 | 3599 | 3429 | 3264 | 3106 | 2954 | 29 | 59 | 88 | 118 | 147 |
| 3  | 11.2806 | 2663  | 2525 | 2391 | 2261 | 2135 | 2012 | 1893 | 1777 | 1664 | 21 | 42 | 63 | 83  | 104 |
| 4  | 11.1554 | 1446  | 1341 | 1238 | 1138 | 1040 | 0944 | 0850 | 0759 | 0669 | 16 | 32 | 49 | 65  | 81  |
| 5  | 11.0580 | 0494  | 0409 | 0326 | 0244 | 0164 | 0085 | 0008 | 9932 | 9857 | 13 | 26 | 40 | 53  | 66  |
| 6  | 10.9784 | 9711  | 9640 | 9570 | 9501 | 9433 | 9367 | 9301 | 9236 | 9172 | 11 | 23 | 34 | 45  | 55  |
| 7  | 10.9109 | 9046  | 8985 | 8924 | 8865 | 8806 | 8748 | 8690 | 8633 | 8577 | 10 | 20 | 29 | 39  | 49  |
| 8  | 10.8522 | 8467  | 8413 | 8360 | 8307 | 8255 | 8203 | 8152 | 8102 | 8052 | 9  | 17 | 26 | 35  | 43  |
| 9  | 10.8003 | 7954  | 7906 | 7858 | 7811 | 7764 | 7718 | 7672 | 7626 | 7581 | 8  | 16 | 23 | 31  | 39  |
| 10 | 10.7537 | 7493  | 7449 | 7406 | 7363 | 7320 | 7278 | 7236 | 7195 | 7154 | 7  | 14 | 21 | 28  | 35  |
| 11 | 10.7113 | 7073  | 7033 | 6994 | 6954 | 6915 | 6877 | 6838 | 6800 | 6763 | 6  | 13 | 19 | 26  | 32  |
| 12 | 10.6725 | 6688  | 6651 | 6615 | 6578 | 6542 | 6507 | 6471 | 6436 | 6401 | 6  | 12 | 18 | 24  | 30  |
| 13 | 10.6366 | 6332  | 6298 | 6264 | 6230 | 6196 | 6163 | 6130 | 6097 | 6065 | 6  | 11 | 17 | 22  | 28  |
| 14 | 10.6032 | 6000  | 5968 | 5936 | 5905 | 5873 | 5842 | 5811 | 5780 | 5750 | 5  | 10 | 15 | 21  | 26  |
| 15 | 10.5719 | 5689  | 5659 | 5629 | 5600 | 5570 | 5541 | 5512 | 5483 | 5454 | 5  | 10 | 15 | 20  | 25  |
| 16 | 10.5425 | 5397  | 5368 | 5340 | 5312 | 5284 | 5256 | 5229 | 5201 | 5174 | 5  | 9  | 14 | 19  | 23  |
| 17 | 10.5147 | 5120  | 5093 | 5066 | 5039 | 5013 | 4986 | 4960 | 4934 | 4908 | 4  | 9  | 13 | 18  | 22  |
| 18 | 10.4882 | 4857  | 4831 | 4805 | 4780 | 4755 | 4730 | 4705 | 4680 | 4655 | 4  | 9  | 13 | 17  | 21  |
| 19 | 10.4630 | 4606  | 4581 | 4557 | 4533 | 4509 | 4484 | 4461 | 4437 | 4413 | 4  | 8  | 12 | 16  | 20  |
| 20 | 10.4389 | 4366  | 4342 | 4319 | 4296 | 4273 | 4250 | 4227 | 4204 | 4181 | 4  | 8  | 12 | 15  | 19  |
| 21 | 10.4158 | 4136  | 4113 | 4091 | 4068 | 4046 | 4024 | 4002 | 3980 | 3958 | 4  | 7  | 11 | 15  | 19  |
| 22 | 10.3936 | 3914  | 3892 | 3871 | 3849 | 3828 | 3806 | 3785 | 3764 | 3743 | 4  | 7  | 11 | 14  | 18  |
| 23 | 10.3721 | 3700  | 3679 | 3659 | 3638 | 3617 | 3596 | 3576 | 3555 | 3535 | 3  | 7  | 10 | 14  | 17  |
| 24 | 10.3514 | 3494  | 3473 | 3453 | 3433 | 3413 | 3393 | 3373 | 3353 | 3333 | 3  | 7  | 10 | 13  | 17  |
| 25 | 10.3313 | 3294  | 3274 | 3254 | 3235 | 3215 | 3196 | 3176 | 3157 | 3137 | 3  | 6  | 10 | 13  | 16  |
| 26 | 10.3118 | 3099  | 3080 | 3061 | 3042 | 3023 | 3004 | 2985 | 2966 | 2947 | 3  | 6  | 9  | 13  | 16  |
| 27 | 10.2928 | 2910  | 2891 | 2872 | 2854 | 2835 | 2817 | 2798 | 2780 | 2762 | 3  | 6  | 9  | 12  | 15  |
| 28 | 10.2743 | 2725  | 2707 | 2689 | 2670 | 2652 | 2634 | 2616 | 2598 | 2580 | 3  | 6  | 9  | 12  | 15  |
| 29 | 10.2562 | 2545  | 2527 | 2509 | 2491 | 2474 | 2456 | 2438 | 2421 | 2403 | 3  | 6  | 9  | 12  | 15  |
| 30 | 10.2386 | 2368  | 2351 | 2333 | 2316 | 2299 | 2281 | 2264 | 2247 | 2229 | 3  | 6  | 9  | 12  | 14  |
| 31 | 10.2212 | 2195  | 2178 | 2161 | 2144 | 2127 | 2110 | 2093 | 2076 | 2059 | 3  | 6  | 9  | 11  | 14  |
| 32 | 10.2042 | 2025  | 2008 | 1992 | 1975 | 1958 | 1941 | 1925 | 1908 | 1891 | 3  | 5  | 8  | 11  | 14  |
| 33 | 10.1875 | 1858  | 1842 | 1825 | 1809 | 1792 | 1776 | 1759 | 1743 | 1726 | 3  | 5  | 8  | 11  | 14  |
| 34 | 10.1710 | 1694  | 1677 | 1661 | 1645 | 1629 | 1612 | 1596 | 1580 | 1564 | 3  | 5  | 8  | 11  | 14  |
| 35 | 10.1548 | 1532  | 1516 | 1499 | 1483 | 1467 | 1451 | 1435 | 1419 | 1403 | 3  | 5  | 8  | 11  | 13  |
| 36 | 10.1387 | 1371  | 1356 | 1340 | 1324 | 1308 | 1292 | 1276 | 1260 | 1245 | 3  | 5  | 8  | 11  | 13  |
| 37 | 10.1229 | 1213  | 1197 | 1182 | 1166 | 1150 | 1135 | 1119 | 1103 | 1088 | 3  | 5  | 8  | 10  | 13  |
| 38 | 10.1072 | 1056  | 1041 | 1025 | 1010 | 0994 | 0978 | 0963 | 0947 | 0932 | 3  | 5  | 8  | 10  | 13  |
| 39 | 10.0916 | 0901  | 0885 | 0870 | 0854 | 0839 | 0824 | 0808 | 0793 | 0777 | 3  | 5  | 8  | 10  | 13  |
| 40 | 10.0762 | 0746  | 0731 | 0716 | 0700 | 0685 | 0670 | 0654 | 0639 | 0624 | 3  | 5  | 8  | 10  | 13  |
| 41 | 10.0608 | 0593  | 0578 | 0562 | 0547 | 0532 | 0517 | 0501 | 0486 | 0471 | 3  | 5  | 8  | 10  | 13  |
| 42 | 10.0456 | 0440  | 0425 | 0410 | 0395 | 0379 | 0364 | 0349 | 0334 | 0319 | 3  | 5  | 8  | 10  | 13  |
| 43 | 10.0303 | 0288  | 0273 | 0258 | 0243 | 0228 | 0212 | 0197 | 0182 | 0167 | 3  | 5  | 8  | 10  | 13  |
| 44 | 10.0152 | 0136  | 0121 | 0106 | 0091 | 0076 | 0061 | 0045 | 0030 | 0015 | 3  | 5  | 8  | 10  | 13  |

N.B.—Numbers in difference columns to be subtracted, not added.—See Rules.



|     | 0'      | 6'   | 12'  | 18'  | 24'  | 30'  | 36'  | 42'  | 48'  | 54'  | 1  | 2  | 3  | 4   | 5   |
|-----|---------|------|------|------|------|------|------|------|------|------|----|----|----|-----|-----|
| 45° | 10°0000 | 9985 | 9970 | 9955 | 9939 | 9924 | 9909 | 9894 | 9879 | 9864 | 3  | 5  | 8  | 10  | 13  |
| 46  | 9°9848  | 9833 | 9818 | 9803 | 9788 | 9773 | 9757 | 9742 | 9727 | 9712 | 3  | 5  | 8  | 10  | 13  |
| 47  | 9°9697  | 9681 | 9666 | 9651 | 9636 | 9621 | 9605 | 9590 | 9575 | 9560 | 3  | 5  | 8  | 10  | 13  |
| 48  | 9°9544  | 9529 | 9514 | 9499 | 9483 | 9468 | 9453 | 9438 | 9422 | 9407 | 3  | 5  | 8  | 10  | 13  |
| 49  | 9°9392  | 9376 | 9361 | 9346 | 9330 | 9315 | 9300 | 9284 | 9269 | 9254 | 3  | 5  | 8  | 10  | 13  |
| 50  | 9°9238  | 9223 | 9207 | 9192 | 9176 | 9161 | 9146 | 9130 | 9115 | 9099 | 3  | 5  | 8  | 10  | 13  |
| 51  | 9°9084  | 9068 | 9053 | 9037 | 9022 | 9006 | 8990 | 8975 | 8959 | 8944 | 3  | 5  | 8  | 10  | 13  |
| 52  | 9°8928  | 8912 | 8897 | 8881 | 8865 | 8850 | 8834 | 8818 | 8803 | 8787 | 3  | 5  | 8  | 10  | 13  |
| 53  | 9°8771  | 8755 | 8740 | 8724 | 8708 | 8692 | 8676 | 8660 | 8644 | 8629 | 3  | 5  | 8  | 11  | 13  |
| 54  | 9°8613  | 8597 | 8581 | 8565 | 8549 | 8533 | 8517 | 8501 | 8484 | 8468 | 3  | 5  | 8  | 11  | 13  |
| 55  | 9°8452  | 8436 | 8420 | 8404 | 8388 | 8371 | 8355 | 8339 | 8323 | 8306 | 3  | 5  | 8  | 11  | 14  |
| 56  | 9°8290  | 8274 | 8257 | 8241 | 8224 | 8208 | 8191 | 8175 | 8158 | 8142 | 3  | 5  | 8  | 11  | 14  |
| 57  | 9°8125  | 8109 | 8092 | 8075 | 8059 | 8042 | 8025 | 8008 | 7992 | 7975 | 3  | 6  | 9  | 11  | 14  |
| 58  | 9°7958  | 7941 | 7924 | 7907 | 7890 | 7873 | 7856 | 7839 | 7822 | 7805 | 3  | 6  | 9  | 11  | 14  |
| 59  | 9°7788  | 7771 | 7753 | 7736 | 7719 | 7701 | 7684 | 7667 | 7649 | 7632 | 3  | 6  | 9  | 12  | 14  |
| 60  | 9°7614  | 7597 | 7579 | 7562 | 7544 | 7526 | 7509 | 7491 | 7473 | 7455 | 3  | 6  | 9  | 12  | 15  |
| 61  | 9°7438  | 7420 | 7402 | 7384 | 7366 | 7348 | 7330 | 7311 | 7293 | 7275 | 3  | 6  | 9  | 12  | 15  |
| 62  | 9°7257  | 7238 | 7220 | 7202 | 7183 | 7165 | 7146 | 7128 | 7109 | 7090 | 3  | 6  | 9  | 12  | 15  |
| 63  | 9°7072  | 7053 | 7034 | 7015 | 6996 | 6977 | 6958 | 6939 | 6920 | 6901 | 3  | 6  | 9  | 13  | 16  |
| 64  | 9°6882  | 6863 | 6843 | 6824 | 6804 | 6785 | 6765 | 6746 | 6726 | 6706 | 3  | 7  | 10 | 13  | 16  |
| 65  | 9°6687  | 6667 | 6647 | 6627 | 6607 | 6587 | 6567 | 6547 | 6527 | 6506 | 3  | 7  | 10 | 13  | 17  |
| 66  | 9°6486  | 6465 | 6445 | 6424 | 6404 | 6383 | 6362 | 6341 | 6321 | 6300 | 3  | 7  | 10 | 14  | 17  |
| 67  | 9°6279  | 6257 | 6236 | 6215 | 6194 | 6172 | 6151 | 6129 | 6108 | 6086 | 4  | 7  | 11 | 14  | 18  |
| 68  | 9°6064  | 6042 | 6020 | 5998 | 5976 | 5954 | 5932 | 5909 | 5887 | 5864 | 4  | 7  | 11 | 15  | 19  |
| 69  | 9°5842  | 5819 | 5796 | 5773 | 5750 | 5727 | 5704 | 5681 | 5658 | 5634 | 4  | 8  | 12 | 15  | 19  |
| 70  | 9°5611  | 5587 | 5563 | 5539 | 5516 | 5491 | 5467 | 5443 | 5419 | 5394 | 4  | 8  | 12 | 16  | 20  |
| 71  | 9°5370  | 5345 | 5320 | 5295 | 5270 | 5245 | 5220 | 5195 | 5169 | 5143 | 4  | 8  | 13 | 17  | 21  |
| 72  | 9°5118  | 5092 | 5066 | 5040 | 5014 | 4987 | 4961 | 4934 | 4907 | 4880 | 4  | 9  | 13 | 18  | 22  |
| 73  | 9°4853  | 4826 | 4799 | 4771 | 4744 | 4716 | 4688 | 4660 | 4632 | 4603 | 5  | 9  | 14 | 19  | 23  |
| 74  | 9°4575  | 4546 | 4517 | 4488 | 4459 | 4430 | 4400 | 4371 | 4341 | 4311 | 5  | 10 | 15 | 20  | 25  |
| 75  | 9°4281  | 4250 | 4220 | 4189 | 4158 | 4127 | 4095 | 4064 | 4032 | 4000 | 5  | 10 | 16 | 21  | 26  |
| 76  | 9°3968  | 3935 | 3903 | 3870 | 3837 | 3804 | 3770 | 3736 | 3702 | 3668 | 6  | 11 | 17 | 22  | 28  |
| 77  | 9°3634  | 3599 | 3564 | 3529 | 3493 | 3458 | 3422 | 3385 | 3349 | 3312 | 6  | 12 | 18 | 24  | 30  |
| 78  | 9°3275  | 3237 | 3200 | 3162 | 3123 | 3085 | 3046 | 3006 | 2967 | 2927 | 6  | 13 | 19 | 26  | 32  |
| 79  | 9°2887  | 2846 | 2805 | 2764 | 2722 | 2680 | 2637 | 2594 | 2551 | 2507 | 7  | 14 | 21 | 28  | 35  |
| 80  | 9°2463  | 2419 | 2374 | 2328 | 2282 | 2236 | 2189 | 2142 | 2094 | 2046 | 8  | 16 | 23 | 31  | 39  |
| 81  | 9°1997  | 1948 | 1898 | 1848 | 1797 | 1745 | 1693 | 1640 | 1587 | 1533 | 9  | 17 | 26 | 35  | 43  |
| 82  | 9°1478  | 1423 | 1367 | 1310 | 1252 | 1194 | 1135 | 1076 | 1015 | 954  | 10 | 20 | 29 | 39  | 49  |
| 83  | 9°0891  | 0828 | 0764 | 0699 | 0633 | 0567 | 0499 | 0430 | 0360 | 0289 | 11 | 23 | 34 | 45  | 56  |
| 84  | 9°0216  | 0143 | 0068 | 9992 | 9915 | 9836 | 9756 | 9674 | 9591 | 9506 | 13 | 27 | 40 | 53  | 66  |
| 85  | 8°9420  | 9331 | 9241 | 9150 | 9056 | 8960 | 8862 | 8762 | 8659 | 8554 | 16 | 32 | 49 | 65  | 81  |
| 86  | 8°8446  | 8336 | 8223 | 8107 | 7988 | 7865 | 7739 | 7609 | 7475 | 7337 | 21 | 42 | 63 | 83  | 104 |
| 87  | 8°7194  | 7046 | 6894 | 6736 | 6571 | 6401 | 6223 | 6038 | 5845 | 5643 | 29 | 59 | 88 | 118 | 147 |
| 88  | 8°5431  | 5208 | 4973 | 4725 | 4461 | 4181 | 3881 | 3559 | 3211 | 2833 |    |    |    |     |     |
| 89  | 8°2419  | 1962 | 1450 | 0870 | 0200 | 9409 | 8439 | 7190 | 5429 | 2419 |    |    |    |     |     |

N.B.—Numbers in difference columns to be subtracted, not added.—See Rules.

|    | 0'      | 6'   | 12'  | 18'  | 24'  | 30'  | 36'  | 42'  | 48'  | 54'  | 1 | 2 | 3 | 4 | 5 |
|----|---------|------|------|------|------|------|------|------|------|------|---|---|---|---|---|
| 0° | 10°0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0001 | 0 | 0 | 0 | 0 | 0 |
| 1  | 10°0001 | 0001 | 0001 | 0001 | 0001 | 0001 | 0002 | 0002 | 0002 | 0002 | 0 | 0 | 0 | 0 | 0 |
| 2  | 10°0003 | 0003 | 0003 | 0004 | 0004 | 0004 | 0004 | 0005 | 0005 | 0006 | 0 | 0 | 0 | 0 | 0 |
| 3  | 10°0006 | 0006 | 0007 | 0007 | 0008 | 0008 | 0009 | 0009 | 0010 | 0010 | 0 | 0 | 0 | 0 | 0 |
| 4  | 10°0011 | 0011 | 0012 | 0012 | 0013 | 0013 | 0014 | 0015 | 0015 | 0016 | 0 | 0 | 0 | 0 | 0 |
| 5  | 10°0017 | 0017 | 0018 | 0019 | 0019 | 0020 | 0021 | 0022 | 0022 | 0023 | 0 | 0 | 0 | 0 | 1 |
| 6  | 10°0024 | 0025 | 0025 | 0026 | 0027 | 0028 | 0029 | 0030 | 0031 | 0032 | 0 | 0 | 0 | 1 | 1 |
| 7  | 10°0032 | 0033 | 0034 | 0035 | 0036 | 0037 | 0038 | 0039 | 0040 | 0041 | 0 | 0 | 0 | 1 | 1 |
| 8  | 10°0042 | 0044 | 0045 | 0046 | 0047 | 0048 | 0049 | 0050 | 0051 | 0053 | 0 | 0 | 1 | 1 | 1 |
| 9  | 10°0054 | 0055 | 0056 | 0057 | 0059 | 0060 | 0061 | 0063 | 0064 | 0065 | 0 | 0 | 1 | 1 | 1 |
| 10 | 10°0066 | 0068 | 0069 | 0071 | 0072 | 0073 | 0075 | 0076 | 0078 | 0079 | 0 | 0 | 1 | 1 | 1 |
| 11 | 10°0081 | 0082 | 0084 | 0085 | 0087 | 0088 | 0090 | 0091 | 0093 | 0094 | 0 | 1 | 1 | 1 | 1 |
| 12 | 10°0096 | 0098 | 0099 | 0101 | 0103 | 0104 | 0106 | 0108 | 0109 | 0111 | 0 | 1 | 1 | 1 | 1 |
| 13 | 10°0113 | 0115 | 0116 | 0118 | 0120 | 0122 | 0124 | 0125 | 0127 | 0129 | 0 | 1 | 1 | 1 | 2 |
| 14 | 10°0131 | 0133 | 0135 | 0137 | 0139 | 0141 | 0143 | 0145 | 0147 | 0149 | 0 | 1 | 1 | 1 | 2 |
| 15 | 10°0151 | 0153 | 0155 | 0157 | 0159 | 0161 | 0163 | 0165 | 0167 | 0169 | 0 | 1 | 1 | 1 | 2 |
| 16 | 10°0172 | 0174 | 0176 | 0178 | 0180 | 0183 | 0185 | 0187 | 0189 | 0192 | 0 | 1 | 1 | 1 | 2 |
| 17 | 10°0194 | 0196 | 0199 | 0201 | 0203 | 0206 | 0208 | 0211 | 0213 | 0215 | 0 | 1 | 1 | 2 | 2 |
| 18 | 10°0218 | 0220 | 0223 | 0225 | 0228 | 0230 | 0233 | 0236 | 0238 | 0241 | 0 | 1 | 1 | 2 | 2 |
| 19 | 10°0243 | 0246 | 0249 | 0251 | 0254 | 0257 | 0259 | 0262 | 0265 | 0267 | 0 | 1 | 1 | 2 | 2 |
| 20 | 10°0270 | 0273 | 0276 | 0278 | 0281 | 0284 | 0287 | 0290 | 0293 | 0296 | 0 | 1 | 1 | 2 | 2 |
| 21 | 10°0298 | 0301 | 0304 | 0307 | 0310 | 0313 | 0316 | 0319 | 0322 | 0325 | 0 | 1 | 1 | 2 | 2 |
| 22 | 10°0328 | 0331 | 0334 | 0338 | 0341 | 0344 | 0347 | 0350 | 0353 | 0357 | 1 | 1 | 2 | 2 | 3 |
| 23 | 10°0360 | 0363 | 0366 | 0369 | 0373 | 0376 | 0379 | 0383 | 0386 | 0389 | 1 | 1 | 2 | 2 | 3 |
| 24 | 10°0393 | 0396 | 0399 | 0403 | 0406 | 0410 | 0413 | 0417 | 0420 | 0424 | 1 | 1 | 2 | 2 | 3 |
| 25 | 10°0427 | 0431 | 0434 | 0438 | 0442 | 0445 | 0449 | 0452 | 0456 | 0460 | 1 | 1 | 2 | 2 | 3 |
| 26 | 10°0463 | 0467 | 0471 | 0475 | 0478 | 0482 | 0486 | 0490 | 0494 | 0497 | 1 | 1 | 2 | 3 | 3 |
| 27 | 10°0501 | 0505 | 0509 | 0513 | 0517 | 0521 | 0525 | 0529 | 0533 | 0537 | 1 | 1 | 2 | 3 | 3 |
| 28 | 10°0541 | 0545 | 0549 | 0553 | 0557 | 0561 | 0565 | 0569 | 0573 | 0578 | 1 | 1 | 2 | 3 | 3 |
| 29 | 10°0582 | 0586 | 0590 | 0594 | 0599 | 0603 | 0607 | 0612 | 0616 | 0620 | 1 | 1 | 2 | 3 | 4 |
| 30 | 10°0625 | 0629 | 0633 | 0638 | 0642 | 0647 | 0651 | 0656 | 0660 | 0665 | 1 | 1 | 2 | 3 | 4 |
| 31 | 10°0669 | 0674 | 0678 | 0683 | 0688 | 0692 | 0697 | 0702 | 0706 | 0711 | 1 | 2 | 2 | 3 | 4 |
| 32 | 10°0716 | 0721 | 0725 | 0730 | 0735 | 0740 | 0745 | 0749 | 0754 | 0759 | 1 | 2 | 2 | 3 | 4 |
| 33 | 10°0764 | 0769 | 0774 | 0779 | 0784 | 0789 | 0794 | 0799 | 0804 | 0809 | 1 | 2 | 2 | 3 | 4 |
| 34 | 10°0814 | 0819 | 0825 | 0830 | 0835 | 0840 | 0845 | 0851 | 0856 | 0861 | 1 | 2 | 3 | 3 | 4 |
| 35 | 10°0866 | 0872 | 0877 | 0882 | 0888 | 0893 | 0899 | 0904 | 0909 | 0915 | 1 | 2 | 3 | 4 | 5 |
| 36 | 10°0920 | 0926 | 0931 | 0937 | 0943 | 0948 | 0954 | 0959 | 0965 | 0971 | 1 | 2 | 3 | 4 | 5 |
| 37 | 10°0977 | 0982 | 0988 | 0994 | 1000 | 1005 | 1011 | 1017 | 1023 | 1029 | 1 | 2 | 3 | 4 | 5 |
| 38 | 10°1035 | 1041 | 1047 | 1053 | 1059 | 1065 | 1071 | 1077 | 1083 | 1089 | 1 | 2 | 3 | 4 | 5 |
| 39 | 10°1095 | 1101 | 1107 | 1113 | 1120 | 1126 | 1132 | 1138 | 1145 | 1151 | 1 | 2 | 3 | 4 | 5 |
| 40 | 10°1157 | 1164 | 1170 | 1177 | 1183 | 1190 | 1196 | 1203 | 1209 | 1216 | 1 | 2 | 3 | 4 | 5 |
| 41 | 10°1222 | 1229 | 1235 | 1242 | 1249 | 1255 | 1262 | 1269 | 1276 | 1282 | 1 | 2 | 3 | 4 | 6 |
| 42 | 10°1289 | 1296 | 1303 | 1310 | 1317 | 1324 | 1331 | 1338 | 1345 | 1352 | 1 | 2 | 3 | 5 | 6 |
| 43 | 10°1359 | 1366 | 1373 | 1380 | 1387 | 1394 | 1402 | 1409 | 1416 | 1423 | 1 | 2 | 4 | 5 | 6 |
| 44 | 10°1431 | 1438 | 1445 | 1453 | 1460 | 1468 | 1475 | 1483 | 1490 | 1498 | 1 | 2 | 4 | 5 | 6 |



# LOGARITHMIC SECANTS.

29

|     | 0'      | 6'   | 12'  | 18'  | 24'  | 30'  | 36'  | 42'  | 48'  | 54'  | 1  | 2  | 3  | 4  | 5  | 6 |
|-----|---------|------|------|------|------|------|------|------|------|------|----|----|----|----|----|---|
| 45° | 10°1505 | 1513 | 1520 | 1528 | 1536 | 1543 | 1551 | 1559 | 1567 | 1574 | 1  | 3  | 4  | 5  | 6  |   |
| 46  | 10°1582 | 1590 | 1598 | 1606 | 1614 | 1622 | 1630 | 1638 | 1646 | 1654 | 1  | 3  | 4  | 5  | 7  |   |
| 47  | 10°1662 | 1670 | 1678 | 1687 | 1695 | 1703 | 1711 | 1720 | 1728 | 1736 | 1  | 3  | 4  | 6  | 7  |   |
| 48  | 10°1745 | 1753 | 1762 | 1770 | 1779 | 1787 | 1796 | 1805 | 1813 | 1822 | 1  | 3  | 4  | 6  | 7  |   |
| 49  | 10°1831 | 1839 | 1848 | 1857 | 1866 | 1875 | 1883 | 1892 | 1901 | 1910 | 1  | 3  | 4  | 6  | 7  |   |
| 50  | 10°1919 | 1928 | 1937 | 1947 | 1956 | 1965 | 1974 | 1983 | 1993 | 2002 | 2  | 3  | 5  | 6  | 8  |   |
| 51  | 10°2011 | 2021 | 2030 | 2040 | 2049 | 2059 | 2068 | 2078 | 2087 | 2097 | 2  | 3  | 5  | 6  | 8  |   |
| 52  | 10°2107 | 2116 | 2126 | 2136 | 2146 | 2156 | 2165 | 2175 | 2185 | 2195 | 2  | 3  | 5  | 7  | 8  |   |
| 53  | 10°2205 | 2215 | 2226 | 2236 | 2246 | 2256 | 2266 | 2277 | 2287 | 2297 | 2  | 3  | 5  | 7  | 9  |   |
| 54  | 10°2308 | 2318 | 2329 | 2339 | 2350 | 2360 | 2371 | 2382 | 2393 | 2403 | 2  | 4  | 5  | 7  | 9  |   |
| 55  | 10°2414 | 2425 | 2436 | 2447 | 2458 | 2469 | 2480 | 2491 | 2502 | 2513 | 2  | 4  | 5  | 7  | 9  |   |
| 56  | 10°2524 | 2536 | 2547 | 2558 | 2570 | 2581 | 2593 | 2604 | 2616 | 2627 | 2  | 4  | 6  | 8  | 10 |   |
| 57  | 10°2639 | 2651 | 2662 | 2674 | 2686 | 2698 | 2710 | 2722 | 2734 | 2746 | 2  | 4  | 6  | 8  | 10 |   |
| 58  | 10°2758 | 2770 | 2782 | 2795 | 2807 | 2819 | 2832 | 2844 | 2856 | 2869 | 2  | 4  | 6  | 8  | 10 |   |
| 59  | 10°2882 | 2894 | 2907 | 2920 | 2932 | 2945 | 2958 | 2971 | 2984 | 2997 | 2  | 4  | 6  | 8  | 11 |   |
| 60  | 10°3010 | 3023 | 3037 | 3050 | 3063 | 3077 | 3090 | 3104 | 3117 | 3131 | 2  | 4  | 7  | 9  | 11 |   |
| 61  | 10°3144 | 3158 | 3172 | 3186 | 3199 | 3213 | 3227 | 3241 | 3256 | 3270 | 2  | 5  | 7  | 9  | 12 |   |
| 62  | 10°3284 | 3298 | 3313 | 3327 | 3341 | 3356 | 3371 | 3385 | 3400 | 3415 | 2  | 5  | 7  | 10 | 12 |   |
| 63  | 10°3430 | 3444 | 3459 | 3474 | 3490 | 3505 | 3520 | 3535 | 3551 | 3566 | 3  | 5  | 8  | 10 | 13 |   |
| 64  | 10°3582 | 3597 | 3613 | 3629 | 3644 | 3660 | 3676 | 3692 | 3708 | 3724 | 3  | 5  | 8  | 11 | 13 |   |
| 65  | 10°3741 | 3757 | 3773 | 3790 | 3806 | 3823 | 3839 | 3856 | 3873 | 3890 | 3  | 6  | 8  | 11 | 14 |   |
| 66  | 10°3907 | 3924 | 3941 | 3958 | 3976 | 3993 | 4010 | 4028 | 4046 | 4063 | 3  | 6  | 9  | 12 | 14 |   |
| 67  | 10°4081 | 4099 | 4117 | 4135 | 4153 | 4172 | 4190 | 4208 | 4227 | 4246 | 3  | 6  | 9  | 12 | 15 |   |
| 68  | 10°4264 | 4283 | 4302 | 4321 | 4340 | 4359 | 4379 | 4398 | 4417 | 4437 | 3  | 6  | 10 | 13 | 16 |   |
| 69  | 10°4457 | 4477 | 4496 | 4516 | 4537 | 4557 | 4577 | 4598 | 4618 | 4639 | 3  | 7  | 10 | 13 | 17 |   |
| 70  | 10°4659 | 4680 | 4701 | 4722 | 4744 | 4765 | 4787 | 4808 | 4830 | 4852 | 4  | 7  | 11 | 14 | 18 |   |
| 71  | 10°4874 | 4896 | 4918 | 4940 | 4963 | 4985 | 5008 | 5031 | 5054 | 5077 | 4  | 8  | 11 | 15 | 19 |   |
| 72  | 10°5100 | 5124 | 5147 | 5171 | 5195 | 5219 | 5243 | 5267 | 5291 | 5316 | 4  | 8  | 12 | 16 | 20 |   |
| 73  | 10°5341 | 5366 | 5391 | 5416 | 5441 | 5467 | 5492 | 5518 | 5544 | 5570 | 4  | 9  | 13 | 17 | 21 |   |
| 74  | 10°5597 | 5623 | 5650 | 5677 | 5704 | 5731 | 5758 | 5786 | 5814 | 5842 | 5  | 9  | 14 | 18 | 23 |   |
| 75  | 10°5870 | 5898 | 5927 | 5956 | 5985 | 6014 | 6043 | 6073 | 6103 | 6133 | 5  | 10 | 15 | 20 | 24 |   |
| 76  | 10°6163 | 6194 | 6225 | 6255 | 6287 | 6318 | 6350 | 6382 | 6414 | 6446 | 5  | 11 | 16 | 21 | 26 |   |
| 77  | 10°6479 | 6512 | 6545 | 6579 | 6613 | 6647 | 6681 | 6716 | 6750 | 6786 | 6  | 11 | 17 | 23 | 28 |   |
| 78  | 10°6821 | 6857 | 6893 | 6930 | 6966 | 7003 | 7041 | 7079 | 7117 | 7155 | 6  | 12 | 19 | 25 | 31 |   |
| 79  | 10°7194 | 7233 | 7273 | 7313 | 7353 | 7394 | 7435 | 7476 | 7518 | 7561 | 7  | 14 | 20 | 27 | 34 |   |
| 80  | 10°7603 | 7647 | 7690 | 7734 | 7779 | 7824 | 7869 | 7915 | 7962 | 8009 | 8  | 15 | 23 | 30 | 38 |   |
| 81  | 10°8057 | 8105 | 8153 | 8203 | 8253 | 8303 | 8354 | 8406 | 8458 | 8511 | 8  | 17 | 25 | 34 | 42 |   |
| 82  | 10°8564 | 8619 | 8674 | 8729 | 8786 | 8843 | 8901 | 8960 | 9019 | 9080 | 10 | 19 | 29 | 38 | 48 |   |
| 83  | 10°9141 | 9203 | 9266 | 9330 | 9395 | 9461 | 9528 | 9597 | 9666 | 9736 | 11 | 22 | 33 | 44 | 56 |   |
| 84  | 10°9808 | 9880 | 9954 | 0030 | 0106 | 0184 | 0264 | 0345 | 0427 | 0511 | 13 | 26 | 39 | 53 | 66 |   |
| 85  | 11°0597 | 0685 | 0774 | 0865 | 0958 | 1054 | 1151 | 1251 | 1353 | 1457 | 16 | 32 | 48 | 64 | 81 |   |
| 86  | 11°1564 | 1674 | 1787 | 1902 | 2021 | 2143 | 2269 | 2398 | 2532 | 2670 |    |    |    |    |    |   |
| 87  | 11°2812 | 2959 | 3111 | 3269 | 3433 | 3603 | 3780 | 3965 | 4158 | 4360 |    |    |    |    |    |   |
| 88  | 11°4572 | 4794 | 5029 | 5277 | 5541 | 5821 | 6120 | 6442 | 6790 | 7168 |    |    |    |    |    |   |
| 89  | 11°7581 | 8039 | 8550 | 9130 | 9800 | 0592 | 1561 | 2810 | 4571 | 7581 |    |    |    |    |    |   |

|    | O'      | 6'    | 12'  | 18'  | 24'  | 30'  | 36'  | 42'  | 48'  | 54'  | 1  | 2  | 3  | 4  | 5  |
|----|---------|-------|------|------|------|------|------|------|------|------|----|----|----|----|----|
| 0° | Inf.    | 12'76 | 4571 | 2810 | 1561 | 0592 | 9800 | 9130 | 8550 | 8039 |    |    |    |    |    |
| 1  | 11'7581 | 7168  | 6790 | 6442 | 6120 | 5821 | 5541 | 5277 | 5029 | 4794 |    |    |    |    |    |
| 2  | 11'4572 | 4360  | 4158 | 3965 | 3780 | 3603 | 3433 | 3269 | 3111 | 2959 |    |    |    |    |    |
| 3  | 11'2812 | 2670  | 2532 | 2398 | 2269 | 2143 | 2021 | 1902 | 1787 | 1674 |    |    |    |    |    |
| 4  | 11'1564 | 1457  | 1353 | 1251 | 1151 | 1054 | 0958 | 0865 | 0774 | 0685 | 16 | 32 | 48 | 64 | 81 |
| 5  | 11'0597 | 0511  | 0427 | 0345 | 0264 | 0184 | 0106 | 0030 | 9954 | 9880 | 13 | 26 | 39 | 53 | 66 |
| 6  | 10'9808 | 9736  | 9666 | 9597 | 9528 | 9461 | 9395 | 9330 | 9266 | 9203 | 11 | 22 | 33 | 44 | 56 |
| 7  | 10'9141 | 9080  | 9019 | 8960 | 8901 | 8843 | 8786 | 8729 | 8674 | 8619 | 10 | 19 | 29 | 38 | 48 |
| 8  | 10'8564 | 8511  | 8458 | 8406 | 8354 | 8303 | 8253 | 8203 | 8153 | 8105 | 8  | 17 | 25 | 34 | 42 |
| 9  | 10'8057 | 8009  | 7962 | 7915 | 7869 | 7824 | 7779 | 7734 | 7690 | 7647 | 8  | 15 | 23 | 30 | 38 |
| 10 | 10'7603 | 7561  | 7518 | 7476 | 7435 | 7394 | 7353 | 7313 | 7273 | 7233 | 7  | 14 | 20 | 27 | 34 |
| 11 | 10'7194 | 7155  | 7117 | 7079 | 7041 | 7003 | 6966 | 6930 | 6893 | 6857 | 6  | 12 | 19 | 25 | 31 |
| 12 | 10'6821 | 6786  | 6750 | 6716 | 6681 | 6647 | 6613 | 6579 | 6545 | 6512 | 6  | 11 | 17 | 23 | 28 |
| 13 | 10'6479 | 6446  | 6414 | 6382 | 6350 | 6318 | 6287 | 6255 | 6225 | 6194 | 5  | 11 | 16 | 21 | 26 |
| 14 | 10'6163 | 6133  | 6103 | 6073 | 6043 | 6014 | 5985 | 5956 | 5927 | 5898 | 5  | 10 | 15 | 20 | 24 |
| 15 | 10'5870 | 5842  | 5814 | 5786 | 5758 | 5731 | 5704 | 5677 | 5650 | 5623 | 5  | 9  | 14 | 18 | 23 |
| 16 | 10'5597 | 5570  | 5544 | 5518 | 5492 | 5467 | 5441 | 5416 | 5391 | 5366 | 4  | 9  | 13 | 17 | 21 |
| 17 | 10'5341 | 5316  | 5291 | 5267 | 5243 | 5219 | 5195 | 5171 | 5147 | 5124 | 4  | 8  | 12 | 16 | 20 |
| 18 | 10'5100 | 5077  | 5054 | 5031 | 5008 | 4985 | 4963 | 4940 | 4918 | 4896 | 4  | 8  | 11 | 15 | 19 |
| 19 | 10'4874 | 4852  | 4830 | 4808 | 4787 | 4765 | 4744 | 4722 | 4701 | 4680 | 4  | 7  | 11 | 14 | 18 |
| 20 | 10'4659 | 4639  | 4618 | 4598 | 4577 | 4557 | 4537 | 4516 | 4496 | 4477 | 3  | 7  | 10 | 13 | 17 |
| 21 | 10'4457 | 4437  | 4417 | 4398 | 4379 | 4359 | 4340 | 4321 | 4302 | 4283 | 3  | 6  | 10 | 13 | 16 |
| 22 | 10'4264 | 4246  | 4227 | 4208 | 4190 | 4172 | 4153 | 4135 | 4117 | 4099 | 3  | 6  | 9  | 12 | 15 |
| 23 | 10'4081 | 4063  | 4046 | 4028 | 4010 | 3993 | 3976 | 3958 | 3941 | 3924 | 3  | 6  | 9  | 12 | 14 |
| 24 | 10'3907 | 3890  | 3873 | 3856 | 3839 | 3823 | 3806 | 3790 | 3773 | 3757 | 3  | 6  | 8  | 11 | 14 |
| 25 | 10'3741 | 3724  | 3708 | 3692 | 3676 | 3660 | 3644 | 3629 | 3613 | 3597 | 3  | 5  | 8  | 11 | 13 |
| 26 | 10'3582 | 3566  | 3551 | 3535 | 3520 | 3505 | 3490 | 3474 | 3459 | 3444 | 3  | 5  | 8  | 10 | 13 |
| 27 | 10'3430 | 3415  | 3400 | 3385 | 3371 | 3356 | 3341 | 3327 | 3313 | 3298 | 2  | 5  | 7  | 10 | 12 |
| 28 | 10'3284 | 3270  | 3256 | 3241 | 3227 | 3213 | 3199 | 3186 | 3172 | 3158 | 2  | 5  | 7  | 9  | 12 |
| 29 | 10'3144 | 3131  | 3117 | 3104 | 3090 | 3077 | 3063 | 3050 | 3037 | 3023 | 2  | 4  | 7  | 9  | 11 |
| 30 | 10'3010 | 2997  | 2984 | 2971 | 2958 | 2945 | 2932 | 2920 | 2907 | 2894 | 2  | 4  | 6  | 8  | 11 |
| 31 | 10'2882 | 2869  | 2856 | 2844 | 2832 | 2819 | 2807 | 2795 | 2782 | 2770 | 2  | 4  | 6  | 8  | 10 |
| 32 | 10'2758 | 2746  | 2734 | 2722 | 2710 | 2698 | 2686 | 2674 | 2662 | 2651 | 2  | 4  | 6  | 8  | 10 |
| 33 | 10'2639 | 2627  | 2616 | 2604 | 2593 | 2581 | 2570 | 2558 | 2547 | 2536 | 2  | 4  | 6  | 8  | 10 |
| 34 | 10'2524 | 2513  | 2502 | 2491 | 2480 | 2469 | 2458 | 2447 | 2436 | 2425 | 2  | 4  | 5  | 7  | 9  |
| 35 | 10'2414 | 2403  | 2393 | 2382 | 2371 | 2360 | 2350 | 2339 | 2329 | 2318 | 2  | 4  | 5  | 7  | 9  |
| 36 | 10'2308 | 2297  | 2287 | 2277 | 2266 | 2256 | 2246 | 2236 | 2226 | 2215 | 2  | 3  | 5  | 7  | 9  |
| 37 | 10'2205 | 2195  | 2185 | 2175 | 2165 | 2156 | 2146 | 2136 | 2126 | 2116 | 2  | 3  | 5  | 7  | 8  |
| 38 | 10'2107 | 2097  | 2087 | 2078 | 2068 | 2059 | 2049 | 2040 | 2030 | 2021 | 2  | 3  | 5  | 6  | 8  |
| 39 | 10'2011 | 2002  | 1993 | 1983 | 1974 | 1965 | 1956 | 1947 | 1937 | 1928 | 2  | 3  | 5  | 6  | 8  |
| 40 | 10'1919 | 1910  | 1901 | 1892 | 1883 | 1875 | 1866 | 1857 | 1848 | 1839 | 1  | 3  | 4  | 6  | 7  |
| 41 | 10'1831 | 1822  | 1813 | 1805 | 1796 | 1787 | 1779 | 1770 | 1762 | 1753 | 1  | 3  | 4  | 6  | 7  |
| 42 | 10'1745 | 1736  | 1728 | 1720 | 1711 | 1703 | 1695 | 1687 | 1678 | 1670 | 1  | 3  | 4  | 6  | 7  |
| 43 | 10'1662 | 1654  | 1646 | 1638 | 1630 | 1622 | 1614 | 1606 | 1598 | 1590 | 1  | 3  | 4  | 5  | 7  |
| 44 | 10'1582 | 1574  | 1567 | 1559 | 1551 | 1543 | 1536 | 1528 | 1520 | 1513 | 1  | 3  | 4  | 5  | 6  |

N.B.—Numbers in difference columns to be subtracted, not added.—See Rules.

|     | 0'      | 6'   | 12'  | 18'  | 24'  | 30'  | 36'  | 42'  | 48'  | 54'  | 1 | 2 | 3 | 4 | 5 |
|-----|---------|------|------|------|------|------|------|------|------|------|---|---|---|---|---|
| 45° | 10°1505 | 1498 | 1490 | 1483 | 1475 | 1468 | 1460 | 1453 | 1445 | 1438 | 1 | 2 | 4 | 5 | 6 |
| 46  | 10°1431 | 1423 | 1416 | 1409 | 1402 | 1394 | 1387 | 1380 | 1373 | 1366 | 1 | 2 | 4 | 5 | 6 |
| 47  | 10°1359 | 1352 | 1345 | 1338 | 1331 | 1324 | 1317 | 1310 | 1303 | 1296 | 1 | 2 | 3 | 5 | 6 |
| 48  | 10°1289 | 1282 | 1276 | 1269 | 1262 | 1255 | 1249 | 1242 | 1235 | 1229 | 1 | 2 | 3 | 4 | 6 |
| 49  | 10°1222 | 1216 | 1209 | 1203 | 1196 | 1190 | 1183 | 1177 | 1170 | 1164 | 1 | 2 | 3 | 4 | 5 |
| 50  | 10°1157 | 1151 | 1145 | 1138 | 1132 | 1126 | 1120 | 1113 | 1107 | 1101 | 1 | 2 | 3 | 4 | 5 |
| 51  | 10°1095 | 1089 | 1083 | 1077 | 1071 | 1065 | 1059 | 1053 | 1047 | 1041 | 1 | 2 | 3 | 4 | 5 |
| 52  | 10°1035 | 1029 | 1023 | 1017 | 1011 | 1005 | 1000 | 0994 | 0988 | 0982 | 1 | 2 | 3 | 4 | 5 |
| 53  | 10°0977 | 0971 | 0965 | 0959 | 0954 | 0948 | 0943 | 0937 | 0931 | 0926 | 1 | 2 | 3 | 4 | 5 |
| 54  | 10°0920 | 0915 | 0909 | 0904 | 0899 | 0893 | 0888 | 0882 | 0877 | 0872 | 1 | 2 | 3 | 4 | 5 |
| 55  | 10°0866 | 0861 | 0856 | 0851 | 0845 | 0840 | 0835 | 0830 | 0825 | 0819 | 1 | 2 | 3 | 3 | 4 |
| 56  | 10°0814 | 0809 | 0804 | 0799 | 0794 | 0789 | 0784 | 0779 | 0774 | 0769 | 1 | 2 | 2 | 3 | 4 |
| 57  | 10°0764 | 0759 | 0754 | 0749 | 0745 | 0740 | 0735 | 0730 | 0725 | 0721 | 1 | 2 | 2 | 3 | 4 |
| 58  | 10°0716 | 0711 | 0706 | 0702 | 0697 | 0692 | 0688 | 0683 | 0678 | 0674 | 1 | 2 | 2 | 3 | 4 |
| 59  | 10°0669 | 0665 | 0660 | 0656 | 0651 | 0647 | 0642 | 0638 | 0633 | 0629 | 1 | 1 | 2 | 3 | 4 |
| 60  | 10°0625 | 0620 | 0616 | 0612 | 0607 | 0603 | 0599 | 0594 | 0590 | 0586 | 1 | 1 | 2 | 3 | 4 |
| 61  | 10°0582 | 0578 | 0573 | 0569 | 0565 | 0561 | 0557 | 0553 | 0549 | 0545 | 1 | 1 | 2 | 3 | 3 |
| 62  | 10°0541 | 0537 | 0533 | 0529 | 0525 | 0521 | 0517 | 0513 | 0509 | 0505 | 1 | 1 | 2 | 3 | 3 |
| 63  | 10°0501 | 0497 | 0494 | 0490 | 0486 | 0482 | 0478 | 0475 | 0471 | 0467 | 1 | 1 | 2 | 3 | 3 |
| 64  | 10°0463 | 0460 | 0456 | 0452 | 0449 | 0445 | 0442 | 0438 | 0434 | 0431 | 1 | 1 | 2 | 2 | 3 |
| 65  | 10°0427 | 0424 | 0420 | 0417 | 0413 | 0410 | 0406 | 0403 | 0399 | 0396 | 1 | 1 | 2 | 2 | 3 |
| 66  | 10°0393 | 0389 | 0386 | 0383 | 0379 | 0376 | 0373 | 0369 | 0366 | 0363 | 1 | 1 | 2 | 2 | 3 |
| 67  | 10°0360 | 0357 | 0353 | 0350 | 0347 | 0344 | 0341 | 0338 | 0334 | 0331 | 1 | 1 | 2 | 2 | 3 |
| 68  | 10°0328 | 0325 | 0322 | 0319 | 0316 | 0313 | 0310 | 0307 | 0304 | 0301 | 0 | 1 | 1 | 2 | 2 |
| 69  | 10°0298 | 0296 | 0293 | 0290 | 0287 | 0284 | 0281 | 0278 | 0276 | 0273 | 0 | 1 | 1 | 2 | 2 |
| 70  | 10°0270 | 0267 | 0265 | 0262 | 0259 | 0257 | 0254 | 0251 | 0249 | 0246 | 0 | 1 | 1 | 2 | 2 |
| 71  | 10°0243 | 0241 | 0238 | 0236 | 0233 | 0230 | 0228 | 0225 | 0223 | 0220 | 0 | 1 | 1 | 2 | 2 |
| 72  | 10°0218 | 0215 | 0213 | 0211 | 0208 | 0206 | 0203 | 0201 | 0199 | 0196 | 0 | 1 | 1 | 2 | 2 |
| 73  | 10°0194 | 0192 | 0189 | 0187 | 0185 | 0183 | 0180 | 0178 | 0176 | 0174 | 0 | 1 | 1 | 1 | 2 |
| 74  | 10°0172 | 0169 | 0167 | 0165 | 0163 | 0161 | 0159 | 0157 | 0155 | 0153 | 0 | 1 | 1 | 1 | 2 |
| 75  | 10°0151 | 0149 | 0147 | 0145 | 0143 | 0141 | 0139 | 0137 | 0135 | 0133 | 0 | 1 | 1 | 1 | 2 |
| 76  | 10°0131 | 0129 | 0127 | 0125 | 0124 | 0122 | 0120 | 0118 | 0116 | 0115 | 0 | 1 | 1 | 1 | 2 |
| 77  | 10°0113 | 0111 | 0109 | 0108 | 0106 | 0104 | 0103 | 0101 | 0099 | 0098 | 0 | 1 | 1 | 1 | 1 |
| 78  | 10°0096 | 0094 | 0093 | 0091 | 0090 | 0088 | 0087 | 0085 | 0084 | 0082 | 0 | 1 | 1 | 1 | 1 |
| 79  | 10°0081 | 0079 | 0078 | 0076 | 0075 | 0073 | 0072 | 0071 | 0069 | 0068 | 0 | 0 | 1 | 1 | 1 |
| 80  | 10°0066 | 0065 | 0064 | 0063 | 0061 | 0060 | 0059 | 0057 | 0056 | 0055 | 0 | 0 | 1 | 1 | 1 |
| 81  | 10°0054 | 0053 | 0051 | 0050 | 0049 | 0048 | 0047 | 0046 | 0045 | 0044 | 0 | 0 | 1 | 1 | 1 |
| 82  | 10°0042 | 0041 | 0040 | 0039 | 0038 | 0037 | 0036 | 0035 | 0034 | 0033 | 0 | 0 | 0 | 1 | 1 |
| 83  | 10°0032 | 0032 | 0031 | 0030 | 0029 | 0028 | 0027 | 0026 | 0025 | 0025 | 0 | 0 | 0 | 1 | 1 |
| 84  | 10°0024 | 0023 | 0022 | 0022 | 0021 | 0020 | 0019 | 0019 | 0018 | 0017 | 0 | 0 | 0 | 0 | 1 |
| 85  | 10°0017 | 0016 | 0015 | 0015 | 0014 | 0013 | 0013 | 0012 | 0012 | 0011 | 0 | 0 | 0 | 0 | 0 |
| 86  | 10°0011 | 0010 | 0010 | 0009 | 0009 | 0008 | 0008 | 0007 | 0007 | 0006 | 0 | 0 | 0 | 0 | 0 |
| 87  | 10°0006 | 0006 | 0005 | 0005 | 0004 | 0004 | 0004 | 0004 | 0003 | 0003 | 0 | 0 | 0 | 0 | 0 |
| 88  | 10°0003 | 0002 | 0002 | 0002 | 0002 | 0001 | 0001 | 0001 | 0001 | 0001 | 0 | 0 | 0 | 0 | 0 |
| 89  | 10°0001 | 0001 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0 | 0 | 0 | 0 | C |



## NATURAL SINES.

|    | 0'   | 6'   | 12'  | 18   | 24'  | 30'  | 36'  | 42'  | 48'  | 54'  | 1 | 2 | 3 | 4  | 5  |
|----|------|------|------|------|------|------|------|------|------|------|---|---|---|----|----|
| 0° | 0000 | 0017 | 0035 | 0052 | 0070 | 0087 | 0105 | 0122 | 0140 | 0157 | 3 | 6 | 9 | 12 | 15 |
| 1  | 0175 | 0192 | 0209 | 0227 | 0244 | 0262 | 0279 | 0297 | 0314 | 0332 | 3 | 6 | 9 | 12 | 15 |
| 2  | 0349 | 0366 | 0384 | 0401 | 0419 | 0436 | 0454 | 0471 | 0488 | 0506 | 3 | 6 | 9 | 12 | 15 |
| 3  | 0523 | 0541 | 0558 | 0576 | 0593 | 0610 | 0628 | 0645 | 0663 | 0680 | 3 | 6 | 9 | 12 | 15 |
| 4  | 0698 | 0715 | 0732 | 0750 | 0767 | 0785 | 0802 | 0819 | 0837 | 0854 | 3 | 6 | 9 | 12 | 15 |
| 5  | 0872 | 0889 | 0906 | 0924 | 0941 | 0958 | 0976 | 0993 | 1011 | 1028 | 3 | 6 | 9 | 12 | 14 |
| 6  | 1045 | 1063 | 1080 | 1097 | 1115 | 1132 | 1149 | 1167 | 1184 | 1201 | 3 | 6 | 9 | 12 | 14 |
| 7  | 1219 | 1236 | 1253 | 1271 | 1288 | 1305 | 1323 | 1340 | 1357 | 1374 | 3 | 6 | 9 | 12 | 14 |
| 8  | 1392 | 1409 | 1426 | 1444 | 1461 | 1478 | 1495 | 1513 | 1530 | 1547 | 3 | 6 | 9 | 12 | 14 |
| 9  | 1564 | 1582 | 1599 | 1616 | 1633 | 1650 | 1668 | 1685 | 1702 | 1719 | 3 | 6 | 9 | 12 | 14 |
| 10 | 1736 | 1754 | 1771 | 1788 | 1805 | 1822 | 1840 | 1857 | 1874 | 1891 | 3 | 6 | 9 | 12 | 14 |
| 11 | 1908 | 1925 | 1942 | 1959 | 1977 | 1994 | 2011 | 2028 | 2045 | 2062 | 3 | 6 | 9 | 11 | 14 |
| 12 | 2079 | 2096 | 2113 | 2130 | 2147 | 2164 | 2181 | 2198 | 2215 | 2232 | 3 | 6 | 9 | 11 | 14 |
| 13 | 2250 | 2267 | 2284 | 2300 | 2317 | 2334 | 2351 | 2368 | 2385 | 2402 | 3 | 6 | 8 | 11 | 14 |
| 14 | 2419 | 2436 | 2453 | 2470 | 2487 | 2504 | 2521 | 2538 | 2554 | 2571 | 3 | 6 | 8 | 11 | 14 |
| 15 | 2588 | 2605 | 2622 | 2639 | 2656 | 2672 | 2689 | 2706 | 2723 | 2740 | 3 | 6 | 8 | 11 | 14 |
| 16 | 2756 | 2773 | 2790 | 2807 | 2823 | 2840 | 2857 | 2874 | 2890 | 2907 | 3 | 6 | 8 | 11 | 14 |
| 17 | 2924 | 2940 | 2957 | 2974 | 2990 | 3007 | 3024 | 3040 | 3057 | 3074 | 3 | 6 | 8 | 11 | 14 |
| 18 | 3090 | 3107 | 3123 | 3140 | 3156 | 3173 | 3190 | 3206 | 3223 | 3239 | 3 | 6 | 8 | 11 | 14 |
| 19 | 3256 | 3272 | 3289 | 3305 | 3322 | 3338 | 3355 | 3371 | 3387 | 3404 | 3 | 5 | 8 | 11 | 14 |
| 20 | 3420 | 3437 | 3453 | 3469 | 3486 | 3502 | 3518 | 3535 | 3551 | 3567 | 3 | 5 | 8 | 11 | 14 |
| 21 | 3584 | 3600 | 3616 | 3633 | 3649 | 3665 | 3681 | 3697 | 3714 | 3730 | 3 | 5 | 8 | 11 | 14 |
| 22 | 3746 | 3762 | 3778 | 3795 | 3811 | 3827 | 3843 | 3859 | 3875 | 3891 | 3 | 5 | 8 | 11 | 14 |
| 23 | 3907 | 3923 | 3939 | 3955 | 3971 | 3987 | 4003 | 4019 | 4035 | 4051 | 3 | 5 | 8 | 11 | 14 |
| 24 | 4067 | 4083 | 4099 | 4115 | 4131 | 4147 | 4163 | 4179 | 4195 | 4210 | 3 | 5 | 8 | 11 | 13 |
| 25 | 4226 | 4242 | 4258 | 4274 | 4289 | 4305 | 4321 | 4337 | 4352 | 4368 | 3 | 5 | 8 | 11 | 13 |
| 26 | 4384 | 4399 | 4415 | 4431 | 4446 | 4462 | 4478 | 4493 | 4509 | 4524 | 3 | 5 | 8 | 10 | 13 |
| 27 | 4540 | 4555 | 4571 | 4586 | 4602 | 4617 | 4633 | 4648 | 4664 | 4679 | 3 | 5 | 8 | 10 | 13 |
| 28 | 4695 | 4710 | 4726 | 4741 | 4756 | 4772 | 4787 | 4802 | 4818 | 4833 | 3 | 5 | 8 | 10 | 13 |
| 29 | 4848 | 4863 | 4879 | 4894 | 4909 | 4924 | 4939 | 4955 | 4970 | 4985 | 3 | 5 | 8 | 10 | 13 |
| 30 | 5000 | 5015 | 5030 | 5045 | 5060 | 5075 | 5090 | 5105 | 5120 | 5135 | 3 | 5 | 8 | 10 | 13 |
| 31 | 5150 | 5165 | 5180 | 5195 | 5210 | 5225 | 5240 | 5255 | 5270 | 5284 | 2 | 5 | 7 | 10 | 12 |
| 32 | 5299 | 5314 | 5329 | 5344 | 5358 | 5373 | 5388 | 5402 | 5417 | 5432 | 2 | 5 | 7 | 10 | 12 |
| 33 | 5446 | 5461 | 5476 | 5490 | 5505 | 5519 | 5534 | 5548 | 5563 | 5577 | 2 | 5 | 7 | 10 | 12 |
| 34 | 5592 | 5606 | 5621 | 5635 | 5650 | 5664 | 5678 | 5693 | 5707 | 5721 | 2 | 5 | 7 | 10 | 12 |
| 35 | 5736 | 5750 | 5764 | 5779 | 5793 | 5807 | 5821 | 5835 | 5850 | 5864 | 2 | 5 | 7 | 10 | 12 |
| 36 | 5878 | 5892 | 5906 | 5920 | 5934 | 5948 | 5962 | 5976 | 5990 | 6004 | 2 | 5 | 7 | 9  | 12 |
| 37 | 6018 | 6032 | 6046 | 6060 | 6074 | 6088 | 6101 | 6115 | 6129 | 6143 | 2 | 5 | 7 | 9  | 12 |
| 38 | 6157 | 6170 | 6184 | 6198 | 6211 | 6225 | 6239 | 6252 | 6266 | 6280 | 2 | 5 | 7 | 9  | 11 |
| 39 | 6293 | 6307 | 6320 | 6334 | 6347 | 6361 | 6374 | 6388 | 6401 | 6414 | 2 | 4 | 7 | 9  | 11 |
| 40 | 6428 | 6441 | 6455 | 6468 | 6481 | 6494 | 6508 | 6521 | 6534 | 6547 | 2 | 4 | 7 | 9  | 11 |
| 41 | 6561 | 6574 | 6587 | 6600 | 6613 | 6626 | 6639 | 6652 | 6665 | 6678 | 2 | 4 | 7 | 9  | 11 |
| 42 | 6691 | 6704 | 6717 | 6730 | 6743 | 6756 | 6769 | 6782 | 6794 | 6807 | 2 | 4 | 6 | 9  | 11 |
| 43 | 6820 | 6833 | 6845 | 6858 | 6871 | 6884 | 6896 | 6909 | 6921 | 6934 | 2 | 4 | 6 | 8  | 11 |
| 44 | 6947 | 6959 | 6972 | 6984 | 6997 | 7009 | 7022 | 7034 | 7046 | 7059 | 2 | 4 | 6 | 8  | 10 |

NATURAL SINES.

33

|     | 0'   | 6'   | 12'  | 18'  | 24'  | 30'              | 36'              | 42'              | 48'              | 54'              | 1 | 2 | 3 | 4 | 5  |
|-----|------|------|------|------|------|------------------|------------------|------------------|------------------|------------------|---|---|---|---|----|
| 45° | 7071 | 7083 | 7096 | 7108 | 7120 | 7133             | 7145             | 7157             | 7169             | 7181             | 2 | 4 | 6 | 8 | 10 |
| 46  | 7193 | 7206 | 7218 | 7230 | 7242 | 7254             | 7266             | 7278             | 7290             | 7302             | 2 | 4 | 6 | 8 | 10 |
| 47  | 7314 | 7325 | 7337 | 7349 | 7361 | 7373             | 7385             | 7396             | 7408             | 7420             | 2 | 4 | 6 | 8 | 10 |
| 48  | 7431 | 7443 | 7455 | 7466 | 7478 | 7490             | 7501             | 7513             | 7524             | 7536             | 2 | 4 | 6 | 8 | 10 |
| 49  | 7547 | 7558 | 7570 | 7581 | 7593 | 7604             | 7615             | 7627             | 7638             | 7649             | 2 | 4 | 6 | 8 | 9  |
| 50  | 7660 | 7672 | 7683 | 7694 | 7705 | 7716             | 7727             | 7738             | 7749             | 7760             | 2 | 4 | 6 | 7 | 9  |
| 51  | 7771 | 7782 | 7793 | 7804 | 7815 | 7826             | 7837             | 7848             | 7859             | 7869             | 2 | 4 | 5 | 7 | 9  |
| 52  | 7880 | 7891 | 7902 | 7912 | 7923 | 7934             | 7944             | 7955             | 7965             | 7976             | 2 | 4 | 5 | 7 | 9  |
| 53  | 7986 | 7997 | 8007 | 8018 | 8028 | 8039             | 8049             | 8059             | 8070             | 8080             | 2 | 3 | 5 | 7 | 9  |
| 54  | 8090 | 8100 | 8111 | 8121 | 8131 | 8141             | 8151             | 8161             | 8171             | 8181             | 2 | 3 | 5 | 7 | 8  |
| 55  | 8192 | 8202 | 8211 | 8221 | 8231 | 8241             | 8251             | 8261             | 8271             | 8281             | 2 | 3 | 5 | 7 | 8  |
| 56  | 8290 | 8300 | 8310 | 8320 | 8329 | 8339             | 8348             | 8358             | 8368             | 8377             | 2 | 3 | 5 | 6 | 8  |
| 57  | 8387 | 8396 | 8406 | 8415 | 8425 | 8434             | 8443             | 8453             | 8462             | 8471             | 2 | 3 | 5 | 6 | 8  |
| 58  | 8480 | 8490 | 8499 | 8508 | 8517 | 8526             | 8536             | 8545             | 8554             | 8563             | 2 | 3 | 5 | 6 | 8  |
| 59  | 8572 | 8581 | 8590 | 8599 | 8607 | 8616             | 8625             | 8634             | 8643             | 8652             | 1 | 3 | 4 | 6 | 7  |
| 60  | 8660 | 8669 | 8678 | 8686 | 8695 | 8704             | 8712             | 8721             | 8729             | 8738             | 1 | 3 | 4 | 6 | 7  |
| 61  | 8746 | 8755 | 8763 | 8771 | 8780 | 8788             | 8796             | 8805             | 8813             | 8821             | 1 | 3 | 4 | 6 | 7  |
| 62  | 8829 | 8838 | 8846 | 8854 | 8862 | 8870             | 8878             | 8886             | 8894             | 8902             | 1 | 3 | 4 | 5 | 7  |
| 63  | 8910 | 8918 | 8926 | 8934 | 8942 | 8949             | 8957             | 8965             | 8973             | 8980             | 1 | 3 | 4 | 5 | 6  |
| 64  | 8988 | 8996 | 9003 | 9011 | 9018 | 9026             | 9033             | 9041             | 9048             | 9056             | 1 | 3 | 4 | 5 | 6  |
| 65  | 9063 | 9070 | 9078 | 9085 | 9092 | 9100             | 9107             | 9114             | 9121             | 9128             | 1 | 2 | 4 | 5 | 6  |
| 66  | 9135 | 9143 | 9150 | 9157 | 9164 | 9171             | 9178             | 9184             | 9191             | 9198             | 1 | 2 | 3 | 5 | 6  |
| 67  | 9205 | 9212 | 9219 | 9225 | 9232 | 9239             | 9245             | 9252             | 9259             | 9265             | 1 | 2 | 3 | 4 | 6  |
| 68  | 9272 | 9278 | 9285 | 9291 | 9298 | 9304             | 9311             | 9317             | 9323             | 9330             | 1 | 2 | 3 | 4 | 5  |
| 69  | 9336 | 9342 | 9348 | 9354 | 9361 | 9367             | 9373             | 9379             | 9385             | 9391             | 1 | 2 | 3 | 4 | 5  |
| 70  | 9397 | 9403 | 9409 | 9415 | 9421 | 9426             | 9432             | 9438             | 9444             | 9449             | 1 | 2 | 3 | 4 | 5  |
| 71  | 9455 | 9461 | 9466 | 9472 | 9478 | 9483             | 9489             | 9494             | 9500             | 9505             | 1 | 2 | 3 | 4 | 5  |
| 72  | 9511 | 9516 | 9521 | 9527 | 9532 | 9537             | 9542             | 9548             | 9553             | 9558             | 1 | 2 | 3 | 4 | 4  |
| 73  | 9563 | 9568 | 9573 | 9578 | 9583 | 9588             | 9593             | 9598             | 9603             | 9608             | 1 | 2 | 2 | 3 | 4  |
| 74  | 9613 | 9617 | 9622 | 9627 | 9632 | 9636             | 9641             | 9646             | 9650             | 9655             | 1 | 2 | 2 | 3 | 4  |
| 75  | 9659 | 9664 | 9668 | 9673 | 9677 | 9681             | 9686             | 9690             | 9694             | 9699             | 1 | 1 | 2 | 3 | 4  |
| 76  | 9703 | 9707 | 9711 | 9715 | 9720 | 9724             | 9728             | 9732             | 9736             | 9740             | 1 | 1 | 2 | 3 | 3  |
| 77  | 9744 | 9748 | 9751 | 9755 | 9759 | 9763             | 9767             | 9770             | 9774             | 9778             | 1 | 1 | 2 | 3 | 3  |
| 78  | 9781 | 9785 | 9789 | 9792 | 9796 | 9799             | 9803             | 9806             | 9810             | 9813             | 1 | 1 | 2 | 2 | 3  |
| 79  | 9816 | 9820 | 9823 | 9826 | 9829 | 9833             | 9836             | 9839             | 9842             | 9845             | 1 | 1 | 2 | 2 | 3  |
| 80  | 9848 | 9851 | 9854 | 9857 | 9860 | 9863             | 9866             | 9869             | 9871             | 9874             | 0 | 1 | 1 | 2 | 2  |
| 81  | 9877 | 9880 | 9882 | 9885 | 9888 | 9890             | 9893             | 9895             | 9898             | 9900             | 0 | 1 | 1 | 2 | 2  |
| 82  | 9903 | 9905 | 9907 | 9910 | 9912 | 9914             | 9917             | 9919             | 9921             | 9923             | 0 | 1 | 1 | 2 | 2  |
| 83  | 9925 | 9928 | 9930 | 9932 | 9934 | 9936             | 9938             | 9940             | 9942             | 9943             | 0 | 1 | 1 | 1 | 2  |
| 84  | 9945 | 9947 | 9949 | 9951 | 9952 | 9954             | 9956             | 9957             | 9959             | 9960             | 0 | 1 | 1 | 1 | 1  |
| 85  | 9962 | 9963 | 9965 | 9966 | 9968 | 9969             | 9971             | 9972             | 9973             | 9974             | 0 | 0 | 1 | 1 | 1  |
| 86  | 9976 | 9977 | 9978 | 9979 | 9980 | 9981             | 9982             | 9983             | 9984             | 9985             | 0 | 0 | 1 | 1 | 1  |
| 87  | 9986 | 9987 | 9988 | 9989 | 9990 | 9990             | 9991             | 9992             | 9993             | 9993             | 0 | 0 | 0 | 1 | 1  |
| 88  | 9994 | 9995 | 9995 | 9996 | 9996 | 9997             | 9997             | 9997             | 9998             | 9998             | 0 | 0 | 0 | 0 | 0  |
| 89  | 9998 | 9999 | 9999 | 9999 | 9999 | I'000<br>nearly. | I'000<br>nearly. | I'000<br>nearly. | I'000<br>nearly. | I'000<br>nearly. | 0 | 0 | 0 | 0 | 0  |

## NATURAL COSINES.

|    | 0'    | 6'               | 12'              | 18'              | 24'              | 30'  | 36'  | 42'  | 48'  | 54'  | 1 | 2 | 3 | 4 | 5  |
|----|-------|------------------|------------------|------------------|------------------|------|------|------|------|------|---|---|---|---|----|
| 0° | I'000 | I'000<br>nearly. | I'000<br>nearly. | I'000<br>nearly. | I'000<br>nearly. | 9999 | 9999 | 9999 | 9999 | 9999 | 0 | 0 | 0 | 0 | 0  |
| 1  | 9998  | 9998             | 9998             | 9997             | 9997             | 9997 | 9996 | 9996 | 9995 | 9995 | 0 | 0 | 0 | 0 | 0  |
| 2  | 9994  | 9993             | 9993             | 9992             | 9991             | 9990 | 9990 | 9989 | 9988 | 9987 | 0 | 0 | 0 | 1 | 1  |
| 3  | 9986  | 9985             | 9984             | 9983             | 9982             | 9981 | 9980 | 9979 | 9978 | 9977 | 0 | 0 | 1 | 1 | 1  |
| 4  | 9976  | 9974             | 9973             | 9972             | 9971             | 9969 | 9968 | 9966 | 9965 | 9963 | 0 | 0 | 1 | 1 | 1  |
| 5  | 9962  | 9960             | 9959             | 9957             | 9955             | 9954 | 9952 | 9951 | 9949 | 9947 | 0 | 1 | 1 | 1 | 2  |
| 6  | 9945  | 9943             | 9942             | 9940             | 9938             | 9936 | 9934 | 9932 | 9930 | 9928 | 0 | 1 | 1 | 1 | 2  |
| 7  | 9925  | 9923             | 9921             | 9919             | 9917             | 9914 | 9912 | 9910 | 9907 | 9905 | 0 | 1 | 1 | 2 | 2  |
| 8  | 9903  | 9900             | 9898             | 9895             | 9893             | 9890 | 9888 | 9885 | 9882 | 9880 | 0 | 1 | 1 | 2 | 2  |
| 9  | 9877  | 9874             | 9871             | 9869             | 9866             | 9863 | 9860 | 9857 | 9854 | 9851 | 0 | 1 | 1 | 2 | 2  |
| 10 | 9848  | 9845             | 9842             | 9839             | 9836             | 9833 | 9829 | 9826 | 9823 | 9820 | 1 | 1 | 2 | 2 | 3  |
| 11 | 9816  | 9813             | 9810             | 9806             | 9803             | 9799 | 9796 | 9792 | 9789 | 9785 | 1 | 1 | 2 | 2 | 3  |
| 12 | 9781  | 9778             | 9774             | 9770             | 9767             | 9763 | 9759 | 9755 | 9751 | 9748 | 1 | 1 | 2 | 3 | 3  |
| 13 | 9744  | 9740             | 9736             | 9732             | 9728             | 9724 | 9720 | 9715 | 9711 | 9707 | 1 | 1 | 2 | 3 | 3  |
| 14 | 9703  | 9699             | 9694             | 9690             | 9686             | 9681 | 9677 | 9673 | 9668 | 9664 | 1 | 1 | 2 | 3 | 4  |
| 15 | 9659  | 9655             | 9650             | 9646             | 9641             | 9636 | 9632 | 9627 | 9622 | 9617 | 1 | 2 | 2 | 3 | 4  |
| 16 | 9613  | 9608             | 9603             | 9598             | 9593             | 9588 | 9583 | 9578 | 9573 | 9568 | 1 | 2 | 2 | 3 | 4  |
| 17 | 9563  | 9558             | 9553             | 9548             | 9542             | 9537 | 9532 | 9527 | 9521 | 9516 | 1 | 2 | 3 | 4 | 4  |
| 18 | 9511  | 9505             | 9500             | 9494             | 9489             | 9483 | 9478 | 9472 | 9466 | 9461 | 1 | 2 | 3 | 4 | 5  |
| 19 | 9455  | 9449             | 9444             | 9438             | 9432             | 9426 | 9421 | 9415 | 9409 | 9403 | 1 | 2 | 3 | 4 | 5  |
| 20 | 9397  | 9391             | 9385             | 9379             | 9373             | 9367 | 9361 | 9354 | 9348 | 9342 | 1 | 2 | 3 | 4 | 5  |
| 21 | 9336  | 9330             | 9323             | 9317             | 9311             | 9304 | 9298 | 9291 | 9285 | 9278 | 1 | 2 | 3 | 4 | 5  |
| 22 | 9272  | 9265             | 9259             | 9252             | 9245             | 9239 | 9232 | 9225 | 9219 | 9212 | 1 | 2 | 3 | 4 | 6  |
| 23 | 9205  | 9198             | 9191             | 9184             | 9178             | 9171 | 9164 | 9157 | 9150 | 9143 | 1 | 2 | 3 | 5 | 6  |
| 24 | 9135  | 9128             | 9121             | 9114             | 9107             | 9100 | 9092 | 9085 | 9078 | 9070 | 1 | 2 | 4 | 5 | 6  |
| 25 | 9063  | 9056             | 9048             | 9041             | 9033             | 9026 | 9018 | 9011 | 9003 | 8996 | 1 | 3 | 4 | 5 | 6  |
| 26 | 8988  | 8980             | 8973             | 8965             | 8957             | 8949 | 8942 | 8934 | 8926 | 8918 | 1 | 3 | 4 | 5 | 6  |
| 27 | 8910  | 8902             | 8894             | 8886             | 8878             | 8870 | 8862 | 8854 | 8846 | 8838 | 1 | 3 | 4 | 5 | 7  |
| 28 | 8829  | 8821             | 8813             | 8805             | 8796             | 8788 | 8780 | 8771 | 8763 | 8755 | 1 | 3 | 4 | 6 | 7  |
| 29 | 8746  | 8738             | 8729             | 8721             | 8712             | 8704 | 8695 | 8686 | 8678 | 8669 | 1 | 3 | 4 | 6 | 7  |
| 30 | 8660  | 8652             | 8643             | 8634             | 8625             | 8616 | 8607 | 8599 | 8590 | 8581 | 1 | 3 | 4 | 6 | 7  |
| 31 | 8572  | 8563             | 8554             | 8545             | 8536             | 8526 | 8517 | 8508 | 8499 | 8490 | 2 | 3 | 5 | 6 | 8  |
| 32 | 8480  | 8471             | 8462             | 8453             | 8443             | 8434 | 8425 | 8415 | 8406 | 8396 | 2 | 3 | 5 | 6 | 8  |
| 33 | 8387  | 8377             | 8368             | 8358             | 8348             | 8339 | 8329 | 8320 | 8310 | 8300 | 2 | 3 | 5 | 6 | 8  |
| 34 | 8290  | 8281             | 8271             | 8261             | 8251             | 8241 | 8231 | 8221 | 8211 | 8202 | 2 | 3 | 5 | 7 | 8  |
| 35 | 8192  | 8181             | 8171             | 8161             | 8151             | 8141 | 8131 | 8121 | 8111 | 8100 | 2 | 3 | 5 | 7 | 8  |
| 36 | 8090  | 8080             | 8070             | 8059             | 8049             | 8039 | 8028 | 8018 | 8007 | 7997 | 2 | 3 | 5 | 7 | 9  |
| 37 | 7986  | 7976             | 7965             | 7955             | 7944             | 7934 | 7923 | 7912 | 7902 | 7891 | 2 | 4 | 5 | 7 | 9  |
| 38 | 7880  | 7869             | 7859             | 7848             | 7837             | 7826 | 7815 | 7804 | 7793 | 7782 | 2 | 4 | 5 | 7 | 9  |
| 39 | 7771  | 7760             | 7749             | 7738             | 7727             | 7716 | 7705 | 7694 | 7683 | 7672 | 2 | 4 | 6 | 7 | 9  |
| 40 | 7660  | 7649             | 7638             | 7627             | 7615             | 7604 | 7593 | 7581 | 7570 | 7559 | 2 | 4 | 6 | 8 | 9  |
| 41 | 7547  | 7536             | 7524             | 7513             | 7501             | 7490 | 7478 | 7466 | 7455 | 7443 | 2 | 4 | 6 | 8 | 10 |
| 42 | 7431  | 7420             | 7408             | 7396             | 7385             | 7373 | 7361 | 7349 | 7337 | 7325 | 2 | 4 | 6 | 8 | 10 |
| 43 | 7314  | 7302             | 7290             | 7278             | 7266             | 7254 | 7242 | 7230 | 7218 | 7206 | 2 | 4 | 6 | 8 | 10 |
| 44 | 7193  | 7181             | 7169             | 7157             | 7145             | 7133 | 7120 | 7108 | 7096 | 7083 | 2 | 4 | 6 | 8 | 10 |

N.B.—Numbers in difference columns to be subtracted, not added.—See Rules.



# NATURAL COSINES.

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|     | 0'   | 6'   | 12'  | 18'  | 24'  | 30'  | 36'  | 42'  | 48'  | 54'  | 1 | 2 | 3 | 4  | 5  |
|-----|------|------|------|------|------|------|------|------|------|------|---|---|---|----|----|
| 45° | 7071 | 7059 | 7046 | 7034 | 7022 | 7009 | 6997 | 6984 | 6972 | 6959 | 2 | 4 | 6 | 8  | 10 |
| 46  | 6947 | 6934 | 6921 | 6909 | 6896 | 6884 | 6871 | 6858 | 6845 | 6833 | 2 | 4 | 6 | 8  | 11 |
| 47  | 6820 | 6807 | 6794 | 6782 | 6769 | 6756 | 6743 | 6730 | 6717 | 6704 | 2 | 4 | 6 | 9  | 11 |
| 48  | 6691 | 6678 | 6665 | 6652 | 6639 | 6626 | 6613 | 6600 | 6587 | 6574 | 2 | 4 | 7 | 9  | 11 |
| 49  | 6561 | 6547 | 6534 | 6521 | 6508 | 6494 | 6481 | 6468 | 6455 | 6441 | 2 | 4 | 7 | 9  | 11 |
| 50  | 6428 | 6414 | 6401 | 6388 | 6374 | 6361 | 6347 | 6334 | 6320 | 6307 | 2 | 4 | 7 | 9  | 11 |
| 51  | 6293 | 6280 | 6266 | 6252 | 6239 | 6225 | 6211 | 6198 | 6184 | 6170 | 2 | 5 | 7 | 9  | 11 |
| 52  | 6157 | 6143 | 6129 | 6115 | 6101 | 6088 | 6074 | 6060 | 6046 | 6032 | 2 | 5 | 7 | 9  | 12 |
| 53  | 6018 | 6004 | 5990 | 5976 | 5962 | 5948 | 5934 | 5920 | 5906 | 5892 | 2 | 5 | 7 | 9  | 12 |
| 54  | 5878 | 5864 | 5850 | 5835 | 5821 | 5807 | 5793 | 5779 | 5764 | 5750 | 2 | 5 | 7 | 9  | 12 |
| 55  | 5736 | 5721 | 5707 | 5693 | 5678 | 5664 | 5650 | 5635 | 5621 | 5606 | 2 | 5 | 7 | 10 | 12 |
| 56  | 5592 | 5577 | 5563 | 5548 | 5534 | 5519 | 5505 | 5490 | 5476 | 5461 | 2 | 5 | 7 | 10 | 12 |
| 57  | 5446 | 5432 | 5417 | 5402 | 5388 | 5373 | 5358 | 5344 | 5329 | 5314 | 2 | 5 | 7 | 10 | 12 |
| 58  | 5299 | 5284 | 5270 | 5255 | 5240 | 5225 | 5210 | 5195 | 5180 | 5165 | 2 | 5 | 7 | 10 | 12 |
| 59  | 5150 | 5135 | 5120 | 5105 | 5090 | 5075 | 5060 | 5045 | 5030 | 5015 | 3 | 5 | 8 | 10 | 13 |
| 60  | 5000 | 4985 | 4970 | 4955 | 4939 | 4924 | 4909 | 4894 | 4879 | 4863 | 3 | 5 | 8 | 10 | 13 |
| 61  | 4848 | 4833 | 4818 | 4802 | 4787 | 4772 | 4756 | 4741 | 4726 | 4710 | 3 | 5 | 8 | 10 | 13 |
| 62  | 4695 | 4679 | 4664 | 4648 | 4633 | 4617 | 4602 | 4586 | 4571 | 4555 | 3 | 5 | 8 | 10 | 13 |
| 63  | 4540 | 4524 | 4509 | 4493 | 4478 | 4462 | 4446 | 4431 | 4415 | 4399 | 3 | 5 | 8 | 10 | 13 |
| 64  | 4384 | 4368 | 4352 | 4337 | 4321 | 4305 | 4289 | 4274 | 4258 | 4242 | 3 | 5 | 8 | 11 | 13 |
| 65  | 4226 | 4210 | 4195 | 4179 | 4163 | 4147 | 4131 | 4115 | 4099 | 4083 | 3 | 5 | 8 | 11 | 13 |
| 66  | 4067 | 4051 | 4035 | 4019 | 4003 | 3987 | 3971 | 3955 | 3939 | 3923 | 3 | 5 | 8 | 11 | 14 |
| 67  | 3907 | 3891 | 3875 | 3859 | 3843 | 3827 | 3811 | 3795 | 3778 | 3762 | 3 | 5 | 8 | 11 | 14 |
| 68  | 3746 | 3730 | 3714 | 3697 | 3681 | 3665 | 3649 | 3633 | 3616 | 3600 | 3 | 5 | 8 | 11 | 14 |
| 69  | 3584 | 3567 | 3551 | 3535 | 3518 | 3502 | 3486 | 3469 | 3453 | 3437 | 3 | 5 | 8 | 11 | 14 |
| 70  | 3420 | 3404 | 3387 | 3371 | 3355 | 3338 | 3322 | 3305 | 3289 | 3272 | 3 | 5 | 8 | 11 | 14 |
| 71  | 3256 | 3239 | 3223 | 3206 | 3190 | 3173 | 3156 | 3140 | 3123 | 3107 | 3 | 6 | 8 | 11 | 14 |
| 72  | 3090 | 3074 | 3057 | 3040 | 3024 | 3007 | 2990 | 2974 | 2957 | 2940 | 3 | 6 | 8 | 11 | 14 |
| 73  | 2924 | 2907 | 2890 | 2874 | 2857 | 2840 | 2823 | 2807 | 2790 | 2773 | 3 | 6 | 8 | 11 | 14 |
| 74  | 2756 | 2740 | 2723 | 2706 | 2689 | 2672 | 2656 | 2639 | 2622 | 2605 | 3 | 6 | 8 | 11 | 14 |
| 75  | 2588 | 2571 | 2554 | 2538 | 2521 | 2504 | 2487 | 2470 | 2453 | 2436 | 3 | 6 | 8 | 11 | 14 |
| 76  | 2419 | 2402 | 2385 | 2368 | 2351 | 2334 | 2317 | 2300 | 2284 | 2267 | 3 | 6 | 8 | 11 | 14 |
| 77  | 2250 | 2233 | 2215 | 2198 | 2181 | 2164 | 2147 | 2130 | 2113 | 2096 | 3 | 6 | 9 | 11 | 14 |
| 78  | 2079 | 2062 | 2045 | 2028 | 2011 | 1994 | 1977 | 1959 | 1942 | 1925 | 3 | 6 | 9 | 11 | 14 |
| 79  | 1908 | 1891 | 1874 | 1857 | 1840 | 1822 | 1805 | 1788 | 1771 | 1754 | 3 | 6 | 9 | 12 | 14 |
| 80  | 1736 | 1719 | 1702 | 1685 | 1668 | 1650 | 1633 | 1616 | 1599 | 1582 | 3 | 6 | 9 | 12 | 14 |
| 81  | 1564 | 1547 | 1530 | 1513 | 1495 | 1478 | 1461 | 1444 | 1426 | 1409 | 3 | 6 | 9 | 12 | 14 |
| 82  | 1392 | 1374 | 1357 | 1340 | 1323 | 1305 | 1288 | 1271 | 1253 | 1236 | 3 | 6 | 9 | 12 | 14 |
| 83  | 1219 | 1201 | 1184 | 1167 | 1149 | 1132 | 1115 | 1097 | 1080 | 1063 | 3 | 6 | 9 | 12 | 14 |
| 84  | 1045 | 1028 | 1011 | 0993 | 0976 | 0958 | 0941 | 0924 | 0906 | 0889 | 3 | 6 | 9 | 12 | 14 |
| 85  | 0872 | 0854 | 0837 | 0819 | 0802 | 0785 | 0767 | 0750 | 0732 | 0715 | 3 | 6 | 9 | 12 | 15 |
| 86  | 0698 | 0680 | 0663 | 0645 | 0628 | 0610 | 0593 | 0576 | 0558 | 0541 | 3 | 6 | 9 | 12 | 15 |
| 87  | 0523 | 0506 | 0488 | 0471 | 0454 | 0436 | 0419 | 0401 | 0384 | 0366 | 3 | 6 | 9 | 12 | 15 |
| 88  | 0349 | 0332 | 0314 | 0297 | 0279 | 0262 | 0244 | 0227 | 0209 | 0192 | 3 | 6 | 9 | 12 | 15 |
| 89  | 0175 | 0157 | 0140 | 0122 | 0105 | 0087 | 0070 | 0052 | 0035 | 0017 | 3 | 6 | 9 | 12 | 15 |

*N.B.*—Numbers in difference columns to be subtracted, not added.—*See Rules.*

|    | 0'   | 6'   | 12'  | 18'  | 24'  | 30'  | 36'  | 42'  | 48'  | 54'  | 1 | 2  | 3  | 4  | 5  |
|----|------|------|------|------|------|------|------|------|------|------|---|----|----|----|----|
| 0° | 0000 | 0017 | 0035 | 0052 | 0070 | 0087 | 0105 | 0122 | 0140 | 0157 | 3 | 6  | 9  | 12 | 14 |
| 1  | 0175 | 0192 | 0209 | 0227 | 0244 | 0262 | 0279 | 0297 | 0314 | 0332 | 3 | 6  | 9  | 12 | 15 |
| 2  | 0349 | 0367 | 0384 | 0402 | 0419 | 0437 | 0454 | 0472 | 0489 | 0507 | 3 | 6  | 9  | 12 | 15 |
| 3  | 0524 | 0542 | 0559 | 0577 | 0594 | 0612 | 0629 | 0647 | 0664 | 0682 | 3 | 6  | 9  | 12 | 15 |
| 4  | 0699 | 0717 | 0734 | 0752 | 0769 | 0787 | 0805 | 0822 | 0840 | 0857 | 3 | 6  | 9  | 12 | 15 |
| 5  | 0875 | 0892 | 0910 | 0928 | 0945 | 0963 | 0981 | 0998 | 1016 | 1033 | 3 | 6  | 9  | 12 | 15 |
| 6  | 1051 | 1069 | 1086 | 1104 | 1122 | 1139 | 1157 | 1175 | 1192 | 1210 | 3 | 6  | 9  | 12 | 15 |
| 7  | 1228 | 1246 | 1263 | 1281 | 1299 | 1317 | 1334 | 1352 | 1370 | 1388 | 3 | 6  | 9  | 12 | 15 |
| 8  | 1405 | 1423 | 1441 | 1459 | 1477 | 1495 | 1512 | 1530 | 1548 | 1566 | 3 | 6  | 9  | 12 | 15 |
| 9  | 1584 | 1602 | 1620 | 1638 | 1655 | 1673 | 1691 | 1709 | 1727 | 1745 | 3 | 6  | 9  | 12 | 15 |
| 10 | 1763 | 1781 | 1799 | 1817 | 1835 | 1853 | 1871 | 1890 | 1908 | 1926 | 3 | 6  | 9  | 12 | 15 |
| 11 | 1944 | 1962 | 1980 | 1998 | 2016 | 2035 | 2053 | 2071 | 2089 | 2107 | 3 | 6  | 9  | 12 | 15 |
| 12 | 2126 | 2144 | 2162 | 2180 | 2199 | 2217 | 2235 | 2254 | 2272 | 2290 | 3 | 6  | 9  | 12 | 15 |
| 13 | 2309 | 2327 | 2345 | 2364 | 2382 | 2401 | 2419 | 2438 | 2456 | 2475 | 3 | 6  | 9  | 12 | 15 |
| 14 | 2493 | 2512 | 2530 | 2549 | 2568 | 2586 | 2605 | 2623 | 2642 | 2661 | 3 | 6  | 9  | 12 | 16 |
| 15 | 2679 | 2698 | 2717 | 2736 | 2754 | 2773 | 2792 | 2811 | 2830 | 2849 | 3 | 6  | 9  | 13 | 16 |
| 16 | 2867 | 2886 | 2905 | 2924 | 2943 | 2962 | 2981 | 3000 | 3019 | 3038 | 3 | 6  | 9  | 13 | 16 |
| 17 | 3057 | 3076 | 3096 | 3115 | 3134 | 3153 | 3172 | 3191 | 3211 | 3230 | 3 | 6  | 10 | 13 | 16 |
| 18 | 3249 | 3269 | 3288 | 3307 | 3327 | 3346 | 3365 | 3385 | 3404 | 3424 | 3 | 6  | 10 | 13 | 16 |
| 19 | 3443 | 3463 | 3482 | 3502 | 3522 | 3541 | 3561 | 3581 | 3600 | 3620 | 3 | 6  | 10 | 13 | 17 |
| 20 | 3640 | 3659 | 3679 | 3699 | 3719 | 3739 | 3759 | 3779 | 3799 | 3819 | 3 | 7  | 10 | 13 | 17 |
| 21 | 3839 | 3859 | 3879 | 3899 | 3919 | 3939 | 3959 | 3979 | 4000 | 4020 | 3 | 7  | 10 | 13 | 17 |
| 22 | 4040 | 4061 | 4081 | 4101 | 4122 | 4142 | 4163 | 4183 | 4204 | 4224 | 3 | 7  | 10 | 14 | 17 |
| 23 | 4245 | 4265 | 4286 | 4307 | 4327 | 4348 | 4369 | 4390 | 4411 | 4431 | 3 | 7  | 10 | 14 | 17 |
| 24 | 4452 | 4473 | 4494 | 4515 | 4536 | 4557 | 4578 | 4599 | 4621 | 4642 | 4 | 7  | 10 | 14 | 18 |
| 25 | 4663 | 4684 | 4706 | 4727 | 4748 | 4770 | 4791 | 4813 | 4834 | 4856 | 4 | 7  | 11 | 14 | 18 |
| 26 | 4877 | 4899 | 4921 | 4942 | 4964 | 4986 | 5008 | 5029 | 5051 | 5073 | 4 | 7  | 11 | 15 | 18 |
| 27 | 5095 | 5117 | 5139 | 5161 | 5184 | 5206 | 5228 | 5250 | 5272 | 5295 | 4 | 7  | 11 | 15 | 18 |
| 28 | 5317 | 5340 | 5362 | 5384 | 5407 | 5430 | 5452 | 5475 | 5498 | 5520 | 4 | 8  | 11 | 15 | 19 |
| 29 | 5543 | 5566 | 5589 | 5612 | 5635 | 5658 | 5681 | 5704 | 5727 | 5750 | 4 | 8  | 12 | 15 | 19 |
| 30 | 5774 | 5797 | 5820 | 5844 | 5867 | 5890 | 5914 | 5938 | 5961 | 5985 | 4 | 8  | 12 | 16 | 20 |
| 31 | 6009 | 6032 | 6056 | 6080 | 6104 | 6128 | 6152 | 6176 | 6200 | 6224 | 4 | 8  | 12 | 16 | 20 |
| 32 | 6249 | 6273 | 6297 | 6322 | 6346 | 6371 | 6395 | 6420 | 6445 | 6469 | 4 | 8  | 12 | 16 | 20 |
| 33 | 6494 | 6519 | 6544 | 6569 | 6594 | 6619 | 6644 | 6669 | 6694 | 6720 | 4 | 8  | 13 | 17 | 21 |
| 34 | 6745 | 6771 | 6796 | 6822 | 6847 | 6873 | 6899 | 6924 | 6950 | 6976 | 4 | 9  | 13 | 17 | 21 |
| 35 | 7002 | 7028 | 7054 | 7080 | 7107 | 7133 | 7159 | 7186 | 7212 | 7239 | 4 | 9  | 13 | 18 | 22 |
| 36 | 7265 | 7292 | 7319 | 7346 | 7373 | 7400 | 7427 | 7454 | 7481 | 7508 | 5 | 9  | 14 | 18 | 23 |
| 37 | 7536 | 7563 | 7590 | 7618 | 7646 | 7673 | 7701 | 7729 | 7757 | 7785 | 5 | 9  | 14 | 18 | 23 |
| 38 | 7813 | 7841 | 7869 | 7898 | 7926 | 7954 | 7983 | 8012 | 8040 | 8069 | 5 | 10 | 14 | 19 | 24 |
| 39 | 8098 | 8127 | 8156 | 8185 | 8214 | 8243 | 8273 | 8302 | 8332 | 8361 | 5 | 10 | 15 | 20 | 24 |
| 40 | 8391 | 8421 | 8451 | 8481 | 8511 | 8541 | 8571 | 8601 | 8632 | 8662 | 5 | 10 | 15 | 20 | 25 |
| 41 | 8693 | 8724 | 8754 | 8785 | 8816 | 8847 | 8878 | 8910 | 8941 | 8972 | 5 | 10 | 16 | 21 | 26 |
| 42 | 9004 | 9036 | 9067 | 9099 | 9131 | 9163 | 9195 | 9228 | 9260 | 9293 | 5 | 11 | 16 | 21 | 27 |
| 43 | 9325 | 9358 | 9391 | 9424 | 9457 | 9490 | 9523 | 9556 | 9590 | 9623 | 6 | 11 | 17 | 22 | 28 |
| 44 | 9657 | 9691 | 9725 | 9759 | 9793 | 9827 | 9861 | 9896 | 9930 | 9965 | 6 | 11 | 17 | 23 | 29 |



# NATURAL TANGENTS.

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|     | O'     | 6'    | 12'   | 18'   | 24'   | 30'   | 36'   | 42'   | 48'   | 54'   | 1   | 2   | 3   | 4   | 5   |
|-----|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|---|-----|-----|-----|-----|
| 45° | 1'0000 | 0035  | 0070  | 0105  | 0141  | 0176  | 0212  | 0247  | 0283  | 0319  | 6   | 12  | 18  | 24  | 30  |
| 46  | 1'0355 | 0392  | 0428  | 0464  | 0501  | 0538  | 0575  | 0612  | 0649  | 0686  | 6   | 12  | 18  | 25  | 31  |
| 47  | 1'0724 | 0761  | 0799  | 0837  | 0875  | 0913  | 0951  | 0990  | 1028  | 1067  | 6   | 13  | 19  | 25  | 32  |
| 48  | 1'1106 | 1145  | 1184  | 1224  | 1263  | 1303  | 1343  | 1383  | 1423  | 1463  | 7   | 13  | 20  | 26  | 33  |
| 49  | 1'1504 | 1544  | 1585  | 1626  | 1667  | 1708  | 1750  | 1792  | 1833  | 1875  | 7   | 14  | 21  | 28  | 34  |
| 50  | 1'1918 | 1960  | 2002  | 2045  | 2088  | 2131  | 2174  | 2218  | 2261  | 2305  | 7   | 14  | 22  | 29  | 36  |
| 51  | 1'2349 | 2393  | 2437  | 2482  | 2527  | 2572  | 2617  | 2662  | 2708  | 2753  | 8   | 15  | 23  | 30  | 38  |
| 52  | 1'2799 | 2846  | 2892  | 2938  | 2985  | 3032  | 3079  | 3127  | 3175  | 3222  | 8   | 16  | 23  | 31  | 39  |
| 53  | 1'3270 | 3319  | 3367  | 3416  | 3465  | 3514  | 3564  | 3613  | 3663  | 3713  | 8   | 16  | 25  | 33  | 41  |
| 54  | 1'3764 | 3814  | 3865  | 3916  | 3968  | 4019  | 4071  | 4124  | 4176  | 4229  | 9   | 17  | 26  | 34  | 43  |
| 55  | 1'4281 | 4335  | 4388  | 4442  | 4496  | 4550  | 4605  | 4659  | 4715  | 4770  | 9   | 18  | 27  | 36  | 45  |
| 56  | 1'4826 | 4882  | 4938  | 4994  | 5051  | 5108  | 5166  | 5224  | 5282  | 5340  | 10  | 19  | 29  | 38  | 48  |
| 57  | 1'5399 | 5458  | 5517  | 5577  | 5637  | 5697  | 5757  | 5818  | 5880  | 5941  | 10  | 20  | 30  | 40  | 50  |
| 58  | 1'6003 | 6066  | 6128  | 6191  | 6255  | 6319  | 6383  | 6447  | 6512  | 6577  | 11  | 21  | 32  | 43  | 53  |
| 59  | 1'6643 | 6709  | 6775  | 6842  | 6909  | 6977  | 7045  | 7113  | 7182  | 7251  | 11  | 23  | 34  | 45  | 56  |
| 60  | 1'7321 | 7391  | 7461  | 7532  | 7603  | 7675  | 7747  | 7820  | 7893  | 7966  | 12  | 24  | 36  | 48  | 60  |
| 61  | 1'8040 | 8115  | 8190  | 8265  | 8341  | 8418  | 8495  | 8572  | 8650  | 8728  | 13  | 26  | 38  | 51  | 64  |
| 62  | 1'8807 | 8887  | 8967  | 9047  | 9128  | 9210  | 9292  | 9375  | 9458  | 9542  | 14  | 27  | 41  | 55  | 68  |
| 63  | 1'9626 | 9711  | 9797  | 9883  | 9970  | 0057  | 0145  | 0233  | 0323  | 0413  | 15  | 29  | 44  | 58  | 73  |
| 64  | 2'0503 | 0594  | 0686  | 0778  | 0872  | 0965  | 1060  | 1155  | 1251  | 1348  | 16  | 31  | 47  | 63  | 78  |
| 65  | 2'1445 | 1543  | 1642  | 1742  | 1842  | 1943  | 2045  | 2148  | 2251  | 2355  | 17  | 34  | 51  | 68  | 85  |
| 66  | 2'2460 | 2566  | 2673  | 2781  | 2889  | 2998  | 3109  | 3220  | 3332  | 3445  | 18  | 37  | 55  | 74  | 92  |
| 67  | 2'3559 | 3673  | 3789  | 3906  | 4023  | 4142  | 4262  | 4383  | 4504  | 4627  | 20  | 40  | 60  | 79  | 99  |
| 68  | 2'4751 | 4876  | 5002  | 5129  | 5257  | 5386  | 5517  | 5649  | 5782  | 5916  | 22  | 43  | 65  | 87  | 108 |
| 69  | 2'6051 | 6187  | 6325  | 6464  | 6605  | 6746  | 6889  | 7034  | 7179  | 7326  | 24  | 47  | 71  | 95  | 118 |
| 70  | 2'7475 | 7625  | 7776  | 7929  | 8083  | 8239  | 8397  | 8556  | 8716  | 8878  | 26  | 52  | 78  | 104 | 130 |
| 71  | 2'9042 | 9208  | 9375  | 9544  | 9714  | 9887  | 0061  | 0237  | 0415  | 0595  | 29  | 58  | 87  | 115 | 144 |
| 72  | 3'0777 | 0961  | 1146  | 1334  | 1524  | 1716  | 1910  | 2106  | 2305  | 2506  | 32  | 64  | 96  | 129 | 161 |
| 73  | 3'2709 | 2914  | 3122  | 3332  | 3544  | 3759  | 3977  | 4197  | 4420  | 4646  | 36  | 72  | 108 | 144 | 180 |
| 74  | 3'4874 | 5105  | 5339  | 5576  | 5816  | 6059  | 6305  | 6554  | 6806  | 7062  | 41  | 82  | 122 | 162 | 203 |
| 75  | 3'7321 | 7583  | 7848  | 8118  | 8391  | 8667  | 8947  | 9232  | 9520  | 9812  | 46  | 94  | 139 | 186 | 232 |
| 76  | 4'0108 | 0408  | 0713  | 1022  | 1335  | 1653  | 1976  | 2303  | 2635  | 2972  | 53  | 107 | 160 | 214 | 267 |
| 77  | 4'3315 | 3662  | 4015  | 4374  | 4737  | 5107  | 5483  | 5864  | 6252  | 6646  | 62  | 124 | 186 | 248 | 310 |
| 78  | 4'7046 | 7453  | 7867  | 8288  | 8716  | 9152  | 9594  | 0045  | 0504  | 0970  | 73  | 146 | 219 | 292 | 365 |
| 79  | 5'1446 | 1929  | 2422  | 2924  | 3435  | 3955  | 4486  | 5026  | 5578  | 6140  | 87  | 175 | 262 | 350 | 437 |
| 80  | 5'6713 | 7297  | 7894  | 8502  | 9124  | 9758  | 0405  | 1066  | 1742  | 2432  | Difference-columns<br>cease to be useful,<br>owing to the rapidity<br>with which the value<br>of the tangent changes. |     |     |     |     |
| 81  | 6'3138 | 3859  | 4596  | 5350  | 6122  | 6912  | 7720  | 8548  | 9395  | 0264  |   |     |     |     |     |
| 82  | 7'1154 | 2066  | 3002  | 3962  | 4947  | 5958  | 6996  | 8062  | 9158  | 0285  |   |     |     |     |     |
| 83  | 8'1443 | 2636  | 3863  | 5126  | 6427  | 7769  | 9152  | 0579  | 2052  | 3572  |   |     |     |     |     |
| 84  | 9'5144 | 9'677 | 9'845 | 10'02 | 10'20 | 10'39 | 10'58 | 10'78 | 10'99 | 11'20 |   |     |     |     |     |
| 85  | 11'43  | 11'66 | 11'91 | 12'16 | 12'43 | 12'71 | 13'00 | 13'30 | 13'62 | 13'95 |   |     |     |     |     |
| 86  | 14'30  | 14'67 | 15'06 | 15'46 | 15'89 | 16'35 | 16'83 | 17'34 | 17'89 | 18'46 |   |     |     |     |     |
| 87  | 19'08  | 19'74 | 20'45 | 21'20 | 22'02 | 22'90 | 23'86 | 24'90 | 26'03 | 27'27 |   |     |     |     |     |
| 88  | 28'64  | 30'14 | 31'82 | 33'69 | 35'80 | 38'19 | 40'92 | 44'07 | 47'74 | 52'08 |   |     |     |     |     |
| 89  | 57'29  | 63'66 | 71'62 | 81'85 | 95'49 | 114'6 | 143'2 | 191'0 | 286'5 | 573'0 |   |     |     |     |     |

|    | 0'     | 6'    | 12'   | 18'   | 24'   | 30'   | 36'   | 42'   | 48'   | 54'   | Difference-columns<br>not useful here, owing<br>to the rapidity with<br>which the value of the<br>cotangent changes. |     |     |     |     |
|----|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|--|-----|-----|-----|-----|
| 0° | Inf.   | 573°0 | 286°5 | 191°0 | 143°2 | 114°6 | 95°49 | 81°85 | 71°62 | 63°66 |  |     |     |     |     |
| 1  | 57°29  | 52°08 | 47°74 | 44°07 | 40°92 | 38°19 | 35°80 | 33°69 | 31°82 | 30°14 |  |     |     |     |     |
| 2  | 28°64  | 27°27 | 26°03 | 24°90 | 23°86 | 22°90 | 22°02 | 21°20 | 20°45 | 19°74 |  |     |     |     |     |
| 3  | 19°08  | 18°46 | 17°89 | 17°34 | 16°83 | 16°35 | 15°89 | 15°46 | 15°06 | 14°67 |  |     |     |     |     |
| 4  | 14°30  | 13°95 | 13°62 | 13°30 | 13°00 | 12°71 | 12°43 | 12°16 | 11°91 | 11°66 |  |     |     |     |     |
| 5  | 11°43  | 11°20 | 10°99 | 10°78 | 10°58 | 10°39 | 10°20 | 10°02 | 9°845 | 9°677 |  |     |     |     |     |
| 6  | 9°5144 | 3572  | 2052  | 0579  | 9152  | 7769  | 6427  | 5126  | 3863  | 2636  |  |     |     |     |     |
| 7  | 8°1443 | 0285  | 9158  | 8062  | 6996  | 5958  | 4947  | 3962  | 3002  | 2066  | 1 2 3 4 5  |     |     |     |     |
| 8  | 7°1154 | 0264  | 9395  | 8548  | 7720  | 6912  | 6122  | 5350  | 4596  | 3859  |  |     |     |     |     |
| 9  | 6°3138 | 2432  | 1742  | 1066  | 0405  | 9758  | 9124  | 8502  | 7894  | 7297  |  |     |     |     |     |
| 10 | 5°6713 | 6140  | 5578  | 5026  | 4486  | 3955  | 3435  | 2924  | 2422  | 1929  |  |     |     |     |     |
| 11 | 5°1446 | 0970  | 0504  | 0045  | 9594  | 9152  | 8716  | 8288  | 7867  | 7453  | 74   | 148 | 222 | 296 | 370 |
| 12 | 4°7046 | 6646  | 6252  | 5864  | 5483  | 5107  | 4737  | 4374  | 4015  | 3662  | 63   | 125 | 188 | 252 | 314 |
| 13 | 4°3315 | 2972  | 2635  | 2303  | 1976  | 1653  | 1335  | 1022  | 0713  | 0408  | 53   | 107 | 160 | 214 | 267 |
| 14 | 4°0108 | 9812  | 9520  | 9232  | 8947  | 8667  | 8391  | 8118  | 7848  | 7583  | 46   | 93  | 139 | 186 | 232 |
| 15 | 3°7321 | 7062  | 6806  | 6554  | 6305  | 6059  | 5816  | 5576  | 5339  | 5105  | 41   | 82  | 122 | 163 | 204 |
| 16 | 3°4874 | 4646  | 4420  | 4197  | 3977  | 3759  | 3544  | 3332  | 3122  | 2914  | 36   | 72  | 108 | 144 | 180 |
| 17 | 3°2709 | 2506  | 2305  | 2106  | 1910  | 1716  | 1524  | 1334  | 1146  | 0961  | 32   | 64  | 96  | 129 | 161 |
| 18 | 3°0777 | 0595  | 0415  | 0237  | 0061  | 9887  | 9714  | 9544  | 9375  | 9208  | 29   | 58  | 87  | 115 | 144 |
| 19 | 2°9042 | 8878  | 8716  | 8556  | 8397  | 8239  | 8083  | 7929  | 7776  | 7625  | 26   | 52  | 78  | 104 | 130 |
| 20 | 2°7475 | 7326  | 7179  | 7034  | 6889  | 6746  | 6605  | 6464  | 6325  | 6187  | 24   | 47  | 71  | 95  | 118 |
| 21 | 2°6051 | 5916  | 5782  | 5649  | 5517  | 5386  | 5257  | 5129  | 5002  | 4876  | 22   | 43  | 65  | 87  | 108 |
| 22 | 2°4751 | 4627  | 4504  | 4383  | 4262  | 4142  | 4023  | 3906  | 3789  | 3673  | 20   | 40  | 60  | 79  | 99  |
| 23 | 2°3559 | 3445  | 3332  | 3220  | 3109  | 2998  | 2889  | 2781  | 2673  | 2566  | 18   | 37  | 55  | 74  | 92  |
| 24 | 2°2460 | 2355  | 2251  | 2148  | 2045  | 1943  | 1842  | 1742  | 1642  | 1543  | 17   | 34  | 51  | 68  | 85  |
| 25 | 2°1445 | 1348  | 1251  | 1155  | 1060  | 0965  | 0872  | 0778  | 0686  | 0594  | 16   | 31  | 47  | 63  | 78  |
| 26 | 2°0503 | 0413  | 0323  | 0233  | 0145  | 0057  | 9970  | 9883  | 9797  | 9711  | 15   | 29  | 44  | 58  | 73  |
| 27 | 1°9626 | 9542  | 9458  | 9375  | 9292  | 9210  | 9128  | 9047  | 8967  | 8887  | 14   | 27  | 41  | 55  | 68  |
| 28 | 1°8807 | 8728  | 8650  | 8572  | 8495  | 8418  | 8341  | 8265  | 8190  | 8115  | 13   | 26  | 38  | 51  | 64  |
| 29 | 1°8040 | 7966  | 7893  | 7820  | 7747  | 7675  | 7603  | 7532  | 7461  | 7391  | 12   | 24  | 36  | 48  | 60  |
| 30 | 1°7321 | 7251  | 7182  | 7113  | 7045  | 6977  | 6909  | 6842  | 6775  | 6709  | 11   | 23  | 34  | 45  | 56  |
| 31 | 1°6643 | 6577  | 6512  | 6447  | 6383  | 6319  | 6255  | 6191  | 6128  | 6066  | 11   | 21  | 32  | 43  | 53  |
| 32 | 1°6003 | 5941  | 5880  | 5818  | 5757  | 5697  | 5637  | 5577  | 5517  | 5458  | 10   | 20  | 30  | 40  | 50  |
| 33 | 1°5399 | 5340  | 5282  | 5224  | 5166  | 5108  | 5051  | 4994  | 4938  | 4882  | 10   | 19  | 29  | 38  | 48  |
| 34 | 1°4826 | 4770  | 4715  | 4659  | 4605  | 4550  | 4496  | 4442  | 4388  | 4335  | 9  | 18  | 27  | 36  | 45  |
| 35 | 1°4281 | 4229  | 4176  | 4124  | 4071  | 4019  | 3968  | 3916  | 3865  | 3814  | 9  | 17  | 26  | 34  | 43  |
| 36 | 1°3764 | 3713  | 3663  | 3613  | 3564  | 3514  | 3465  | 3416  | 3367  | 3319  | 8  | 16  | 25  | 33  | 41  |
| 37 | 1°3270 | 3222  | 3175  | 3127  | 3079  | 3032  | 2985  | 2938  | 2892  | 2846  | 8  | 16  | 23  | 31  | 39  |
| 38 | 1°2799 | 2753  | 2708  | 2662  | 2617  | 2572  | 2527  | 2482  | 2437  | 2393  | 8  | 15  | 23  | 30  | 38  |
| 39 | 1°2349 | 2305  | 2261  | 2218  | 2174  | 2131  | 2088  | 2045  | 2002  | 1960  | 7  | 14  | 22  | 29  | 36  |
| 40 | 1°1918 | 1875  | 1833  | 1792  | 1750  | 1708  | 1667  | 1626  | 1585  | 1544  | 7  | 14  | 21  | 28  | 34  |
| 41 | 1°1504 | 1463  | 1423  | 1383  | 1343  | 1303  | 1263  | 1224  | 1184  | 1145  | 7  | 13  | 20  | 26  | 33  |
| 42 | 1°1106 | 1067  | 1028  | 0990  | 0951  | 0913  | 0875  | 0837  | 0799  | 0761  | 6  | 13  | 19  | 25  | 32  |
| 43 | 1°0724 | 0686  | 0649  | 0612  | 0575  | 0538  | 0501  | 0464  | 0428  | 0392  | 6  | 12  | 18  | 25  | 31  |
| 44 | 1°0355 | 0319  | 0283  | 0247  | 0212  | 0176  | 0141  | 0105  | 0070  | 0035  | 6  | 12  | 18  | 24  | 30  |

N.B.—Numbers in difference columns to be subtracted, not added.—See Rules.

|     | 0'    | 6'     | 12'    | 18'    | 24'    | 30'    | 36'    | 42'    | 48'    | 54'    | 1 2 3   | 4 5   |
|-----|-------|--------|--------|--------|--------|--------|--------|--------|--------|--------|---------|-------|
| 45° | 1°0   | 0°9965 | 0°9930 | 0°9896 | 0°9861 | 0°9827 | 0°9793 | 0°9759 | 0°9725 | 0°9691 | 6 11 17 | 23 29 |
| 46  | °9657 | 9623   | 9590   | 9556   | 9523   | 9490   | 9457   | 9424   | 9391   | 9358   | 6 11 17 | 22 28 |
| 47  | °9325 | 9293   | 9260   | 9228   | 9195   | 9163   | 9131   | 9099   | 9067   | 9036   | 5 11 16 | 21 27 |
| 48  | °9004 | 8972   | 8941   | 8910   | 8878   | 8847   | 8816   | 8785   | 8754   | 8724   | 5 10 16 | 21 26 |
| 49  | °8693 | 8662   | 8632   | 8601   | 8571   | 8541   | 8511   | 8481   | 8451   | 8421   | 5 10 15 | 20 25 |
| 50  | °8391 | 8361   | 8332   | 8302   | 8273   | 8243   | 8214   | 8185   | 8156   | 8127   | 5 10 15 | 20 24 |
| 51  | °8098 | 8069   | 8040   | 8012   | 7983   | 7954   | 7926   | 7898   | 7869   | 7841   | 5 10 14 | 19 24 |
| 52  | °7813 | 7785   | 7757   | 7729   | 7701   | 7673   | 7646   | 7618   | 7590   | 7563   | 5 9 14  | 18 23 |
| 53  | °7536 | 7508   | 7481   | 7454   | 7427   | 7400   | 7373   | 7346   | 7319   | 7292   | 5 9 14  | 18 23 |
| 54  | °7265 | 7239   | 7212   | 7186   | 7159   | 7133   | 7107   | 7080   | 7054   | 7028   | 4 9 13  | 18 22 |
| 55  | °7002 | 6976   | 6950   | 6924   | 6899   | 6873   | 6847   | 6822   | 6796   | 6771   | 4 9 13  | 17 21 |
| 56  | °6745 | 6720   | 6694   | 6669   | 6644   | 6619   | 6594   | 6569   | 6544   | 6519   | 4 8 13  | 17 21 |
| 57  | °6494 | 6469   | 6445   | 6420   | 6395   | 6371   | 6346   | 6322   | 6297   | 6273   | 4 8 12  | 16 20 |
| 58  | °6249 | 6224   | 6200   | 6176   | 6152   | 6128   | 6104   | 6080   | 6056   | 6032   | 4 8 12  | 16 20 |
| 59  | °6009 | 5985   | 5961   | 5938   | 5914   | 5890   | 5867   | 5844   | 5820   | 5797   | 4 8 12  | 16 20 |
| 60  | °5774 | 5750   | 5727   | 5704   | 5681   | 5658   | 5635   | 5612   | 5589   | 5566   | 4 8 12  | 15 19 |
| 61  | °5543 | 5520   | 5498   | 5475   | 5452   | 5430   | 5407   | 5384   | 5362   | 5340   | 4 8 11  | 15 19 |
| 62  | °5317 | 5295   | 5272   | 5250   | 5228   | 5206   | 5184   | 5161   | 5139   | 5117   | 4 7 11  | 15 18 |
| 63  | °5095 | 5073   | 5051   | 5029   | 5008   | 4986   | 4964   | 4942   | 4921   | 4899   | 4 7 11  | 15 18 |
| 64  | °4877 | 4856   | 4834   | 4813   | 4791   | 4770   | 4748   | 4727   | 4706   | 4684   | 4 7 11  | 14 18 |
| 65  | °4663 | 4642   | 4621   | 4599   | 4578   | 4557   | 4536   | 4515   | 4494   | 4473   | 4 7 10  | 14 18 |
| 66  | °4452 | 4431   | 4411   | 4390   | 4369   | 4348   | 4327   | 4307   | 4286   | 4265   | 3 7 10  | 14 17 |
| 67  | °4245 | 4224   | 4204   | 4183   | 4163   | 4142   | 4122   | 4101   | 4081   | 4061   | 3 7 10  | 14 17 |
| 68  | °4040 | 4020   | 4000   | 3979   | 3959   | 3939   | 3919   | 3899   | 3879   | 3859   | 3 7 10  | 13 17 |
| 69  | °3839 | 3819   | 3799   | 3779   | 3759   | 3739   | 3719   | 3699   | 3679   | 3659   | 3 7 10  | 13 17 |
| 70  | °3640 | 3620   | 3600   | 3581   | 3561   | 3541   | 3522   | 3502   | 3482   | 3463   | 3 6 10  | 13 17 |
| 71  | °3443 | 3424   | 3404   | 3385   | 3365   | 3346   | 3327   | 3307   | 3288   | 3269   | 3 6 10  | 13 16 |
| 72  | °3249 | 3230   | 3211   | 3191   | 3172   | 3153   | 3134   | 3115   | 3096   | 3076   | 3 6 10  | 13 16 |
| 73  | °3057 | 3038   | 3019   | 3000   | 2981   | 2962   | 2943   | 2924   | 2905   | 2886   | 3 6 9   | 13 16 |
| 74  | °2867 | 2849   | 2830   | 2811   | 2792   | 2773   | 2754   | 2736   | 2717   | 2698   | 3 6 9   | 13 16 |
| 75  | °2679 | 2661   | 2642   | 2623   | 2605   | 2586   | 2568   | 2549   | 2530   | 2512   | 3 6 9   | 12 16 |
| 76  | °2493 | 2475   | 2456   | 2438   | 2419   | 2401   | 2382   | 2364   | 2345   | 2327   | 3 6 9   | 12 15 |
| 77  | °2309 | 2290   | 2272   | 2254   | 2235   | 2217   | 2199   | 2180   | 2162   | 2144   | 3 6 9   | 12 15 |
| 78  | °2126 | 2107   | 2089   | 2071   | 2053   | 2035   | 2016   | 1998   | 1980   | 1962   | 3 6 9   | 12 15 |
| 79  | °1944 | 1926   | 1908   | 1890   | 1871   | 1853   | 1835   | 1817   | 1799   | 1781   | 3 6 9   | 12 15 |
| 80  | °1763 | 1745   | 1727   | 1709   | 1691   | 1673   | 1655   | 1638   | 1620   | 1602   | 3 6 9   | 12 15 |
| 81  | °1584 | 1566   | 1548   | 1530   | 1512   | 1495   | 1477   | 1459   | 1441   | 1423   | 3 6 9   | 12 15 |
| 82  | °1405 | 1388   | 1370   | 1352   | 1334   | 1317   | 1299   | 1281   | 1263   | 1246   | 3 6 9   | 12 15 |
| 83  | °1228 | 1210   | 1192   | 1175   | 1157   | 1139   | 1122   | 1104   | 1086   | 1069   | 3 6 9   | 12 15 |
| 84  | °1051 | 1033   | 1016   | 0998   | 0981   | 0963   | 0945   | 0928   | 0910   | 0892   | 3 6 9   | 12 15 |
| 85  | °0875 | 0857   | 0840   | 0822   | 0805   | 0787   | 0769   | 0752   | 0734   | 0717   | 3 6 9   | 12 15 |
| 86  | °0699 | 0682   | 0664   | 0647   | 0629   | 0612   | 0594   | 0577   | 0559   | 0542   | 3 6 9   | 12 15 |
| 87  | °0524 | 0507   | 0489   | 0472   | 0454   | 0437   | 0419   | 0402   | 0384   | 0367   | 3 6 9   | 12 15 |
| 88  | °0349 | 0332   | 0314   | 0297   | 0279   | 0262   | 0244   | 0227   | 0209   | 0192   | 3 6 9   | 12 15 |
| 89  | °0175 | 0157   | 0140   | 0122   | 0105   | 0087   | 0070   | 0052   | 0035   | 0017   | 3 6 9   | 12 14 |

*N.B.*—Numbers in difference columns to be subtracted, not added.—*See Rules.*



|    | 0'     | 6'   | 12'  | 18'  | 24'  | 30'  | 36'  | 42'  | 48'  | 54'  | 1 | 2 | 3  | 4  | 5  |
|----|--------|------|------|------|------|------|------|------|------|------|---|---|----|----|----|
| 0° | I'0000 | 0000 | 0000 | 0000 | 0000 | 0000 | 0001 | 0001 | 0001 | 0001 | 0 | 0 | 0  | 0  | 0  |
| 1  | I'0002 | 0002 | 0002 | 0003 | 0003 | 0003 | 0004 | 0004 | 0005 | 0006 | 0 | 0 | 0  | 0  | 0  |
| 2  | I'0006 | 0007 | 0007 | 0008 | 0009 | 0010 | 0010 | 0011 | 0012 | 0013 | 0 | 0 | 0  | 0  | 0  |
| 3  | I'0014 | 0015 | 0016 | 0017 | 0018 | 0019 | 0020 | 0021 | 0022 | 0023 | 0 | 0 | 1  | 1  | 1  |
| 4  | I'0024 | 0026 | 0027 | 0028 | 0030 | 0031 | 0032 | 0034 | 0035 | 0037 | 0 | 0 | 1  | 1  | 1  |
| 5  | I'0038 | 0040 | 0041 | 0043 | 0045 | 0046 | 0048 | 0050 | 0051 | 0053 | 0 | 1 | 1  | 1  | 1  |
| 6  | I'0055 | 0057 | 0059 | 0061 | 0063 | 0065 | 0067 | 0069 | 0071 | 0073 | 0 | 1 | 1  | 1  | 2  |
| 7  | I'0075 | 0077 | 0079 | 0082 | 0084 | 0086 | 0089 | 0091 | 0093 | 0096 | 0 | 1 | 1  | 2  | 2  |
| 8  | I'0098 | 0101 | 0103 | 0106 | 0108 | 0111 | 0114 | 0116 | 0119 | 0122 | 0 | 1 | 1  | 2  | 2  |
| 9  | I'0125 | 0127 | 0130 | 0133 | 0136 | 0139 | 0142 | 0145 | 0148 | 0151 | 0 | 1 | 1  | 2  | 2  |
| 10 | I'0154 | 0157 | 0161 | 0164 | 0167 | 0170 | 0174 | 0177 | 0180 | 0184 | 1 | 1 | 2  | 2  | 3  |
| 11 | I'0187 | 0191 | 0194 | 0198 | 0201 | 0205 | 0209 | 0212 | 0216 | 0220 | 1 | 1 | 2  | 3  | 3  |
| 12 | I'0223 | 0227 | 0231 | 0235 | 0239 | 0243 | 0247 | 0251 | 0255 | 0259 | 1 | 1 | 2  | 3  | 3  |
| 13 | I'0263 | 0267 | 0271 | 0276 | 0280 | 0284 | 0288 | 0293 | 0297 | 0302 | 1 | 1 | 2  | 3  | 4  |
| 14 | I'0306 | 0311 | 0315 | 0320 | 0324 | 0329 | 0334 | 0338 | 0343 | 0348 | 1 | 2 | 2  | 3  | 4  |
| 15 | I'0353 | 0358 | 0363 | 0367 | 0372 | 0377 | 0382 | 0388 | 0393 | 0398 | 1 | 2 | 3  | 3  | 4  |
| 16 | I'0403 | 0408 | 0413 | 0419 | 0424 | 0429 | 0435 | 0440 | 0446 | 0451 | 1 | 2 | 3  | 4  | 5  |
| 17 | I'0457 | 0463 | 0468 | 0474 | 0480 | 0485 | 0491 | 0497 | 0503 | 0509 | 1 | 2 | 3  | 4  | 5  |
| 18 | I'0515 | 0521 | 0527 | 0533 | 0539 | 0545 | 0551 | 0557 | 0564 | 0570 | 1 | 2 | 3  | 4  | 5  |
| 19 | I'0576 | 0583 | 0589 | 0595 | 0602 | 0608 | 0615 | 0622 | 0628 | 0635 | 1 | 2 | 3  | 4  | 5  |
| 20 | I'0642 | 0649 | 0655 | 0662 | 0669 | 0676 | 0683 | 0690 | 0697 | 0704 | 1 | 2 | 3  | 5  | 6  |
| 21 | I'0711 | 0719 | 0726 | 0733 | 0740 | 0748 | 0755 | 0763 | 0770 | 0778 | 1 | 2 | 4  | 5  | 6  |
| 22 | I'0785 | 0793 | 0801 | 0808 | 0816 | 0824 | 0832 | 0840 | 0848 | 0856 | 1 | 3 | 4  | 5  | 6  |
| 23 | I'0864 | 0872 | 0880 | 0888 | 0896 | 0904 | 0913 | 0921 | 0929 | 0938 | 1 | 3 | 4  | 6  | 7  |
| 24 | I'0946 | 0955 | 0963 | 0972 | 0981 | 0989 | 0998 | 1007 | 1016 | 1025 | 1 | 3 | 4  | 6  | 7  |
| 25 | I'1034 | 1043 | 1052 | 1061 | 1070 | 1079 | 1089 | 1098 | 1107 | 1117 | 2 | 3 | 5  | 6  | 8  |
| 26 | I'1126 | 1136 | 1145 | 1155 | 1164 | 1174 | 1184 | 1194 | 1203 | 1213 | 2 | 3 | 5  | 6  | 8  |
| 27 | I'1223 | 1233 | 1243 | 1253 | 1264 | 1274 | 1284 | 1294 | 1305 | 1315 | 2 | 3 | 5  | 7  | 9  |
| 28 | I'1326 | 1336 | 1347 | 1357 | 1368 | 1379 | 1390 | 1401 | 1412 | 1423 | 2 | 4 | 5  | 7  | 9  |
| 29 | I'1434 | 1445 | 1456 | 1467 | 1478 | 1490 | 1501 | 1512 | 1524 | 1535 | 2 | 4 | 6  | 8  | 9  |
| 30 | I'1547 | 1559 | 1570 | 1582 | 1594 | 1606 | 1618 | 1630 | 1642 | 1654 | 2 | 4 | 6  | 8  | 10 |
| 31 | I'1666 | 1679 | 1691 | 1703 | 1716 | 1728 | 1741 | 1753 | 1766 | 1779 | 2 | 4 | 6  | 8  | 10 |
| 32 | I'1792 | 1805 | 1818 | 1831 | 1844 | 1857 | 1870 | 1883 | 1897 | 1910 | 2 | 4 | 7  | 9  | 11 |
| 33 | I'1924 | 1937 | 1951 | 1964 | 1978 | 1992 | 2006 | 2020 | 2034 | 2048 | 2 | 5 | 7  | 9  | 12 |
| 34 | I'2062 | 2076 | 2091 | 2105 | 2120 | 2134 | 2149 | 2163 | 2178 | 2193 | 2 | 5 | 7  | 10 | 12 |
| 35 | I'2208 | 2223 | 2238 | 2253 | 2268 | 2283 | 2299 | 2314 | 2329 | 2345 | 3 | 5 | 8  | 10 | 13 |
| 36 | I'2361 | 2376 | 2392 | 2408 | 2424 | 2440 | 2456 | 2472 | 2489 | 2505 | 3 | 5 | 8  | 11 | 13 |
| 37 | I'2521 | 2538 | 2554 | 2571 | 2588 | 2605 | 2622 | 2639 | 2656 | 2673 | 3 | 6 | 8  | 11 | 14 |
| 38 | I'2690 | 2708 | 2725 | 2742 | 2760 | 2778 | 2796 | 2813 | 2831 | 2849 | 3 | 6 | 9  | 12 | 15 |
| 39 | I'2868 | 2886 | 2904 | 2923 | 2941 | 2960 | 2978 | 2997 | 3016 | 3035 | 3 | 6 | 9  | 12 | 16 |
| 40 | I'3054 | 3073 | 3093 | 3112 | 3131 | 3151 | 3171 | 3190 | 3210 | 3230 | 3 | 7 | 10 | 13 | 16 |
| 41 | I'3250 | 3270 | 3291 | 3311 | 3331 | 3352 | 3373 | 3393 | 3414 | 3435 | 3 | 7 | 10 | 14 | 17 |
| 42 | I'3456 | 3478 | 3499 | 3520 | 3542 | 3563 | 3585 | 3607 | 3629 | 3651 | 4 | 7 | 11 | 14 | 18 |
| 43 | I'3673 | 3696 | 3718 | 3741 | 3763 | 3786 | 3809 | 3832 | 3855 | 3878 | 4 | 8 | 11 | 15 | 19 |
| 44 | I'3902 | 3925 | 3949 | 3972 | 3996 | 4020 | 4044 | 4069 | 4093 | 4118 | 4 | 8 | 12 | 16 | 20 |



|     | 0'     | 6'    | 12'   | 18'   | 24'   | 30'   | 36'   | 42'   | 48'   | 54'   | 1  | 2   | 3   | 4   | 5   |
|-----|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|----|-----|-----|-----|-----|
| 45° | 1'4142 | 4167  | 4192  | 4217  | 4242  | 4267  | 4293  | 4318  | 4344  | 4370  | 4  | 8   | 13  | 17  | 21  |
| 46  | 1'4396 | 4422  | 4448  | 4474  | 4501  | 4527  | 4554  | 4581  | 4608  | 4635  | 4  | 9   | 13  | 18  | 22  |
| 47  | 1'4663 | 4690  | 4718  | 4746  | 4774  | 4802  | 4830  | 4859  | 4887  | 4916  | 5  | 9   | 14  | 19  | 23  |
| 48  | 1'4945 | 4974  | 5003  | 5032  | 5062  | 5092  | 5121  | 5151  | 5182  | 5212  | 5  | 10  | 15  | 20  | 25  |
| 49  | 1'5243 | 5273  | 5304  | 5335  | 5366  | 5398  | 5429  | 5461  | 5493  | 5525  | 5  | 10  | 16  | 21  | 26  |
| 50  | 1'5557 | 5590  | 5622  | 5655  | 5688  | 5721  | 5755  | 5788  | 5822  | 5856  | 6  | 11  | 17  | 22  | 28  |
| 51  | 1'5890 | 5925  | 5959  | 5994  | 6029  | 6064  | 6099  | 6135  | 6171  | 6207  | 6  | 12  | 18  | 24  | 29  |
| 52  | 1'6243 | 6279  | 6316  | 6353  | 6390  | 6427  | 6464  | 6502  | 6540  | 6578  | 6  | 12  | 19  | 25  | 31  |
| 53  | 1'6616 | 6655  | 6694  | 6733  | 6772  | 6812  | 6852  | 6892  | 6932  | 6972  | 7  | 13  | 20  | 26  | 33  |
| 54  | 1'7013 | 7054  | 7095  | 7137  | 7179  | 7221  | 7263  | 7305  | 7348  | 7391  | 7  | 14  | 21  | 28  | 35  |
| 55  | 1'7434 | 7478  | 7522  | 7566  | 7610  | 7655  | 7700  | 7745  | 7791  | 7837  | 7  | 15  | 22  | 30  | 37  |
| 56  | 1'7883 | 7929  | 7976  | 8023  | 8070  | 8118  | 8166  | 8214  | 8263  | 8312  | 8  | 16  | 24  | 32  | 40  |
| 57  | 1'8361 | 8410  | 8460  | 8510  | 8561  | 8612  | 8663  | 8714  | 8766  | 8818  | 9  | 17  | 26  | 34  | 43  |
| 58  | 1'8871 | 8924  | 8977  | 9031  | 9084  | 9139  | 9194  | 9249  | 9304  | 9360  | 9  | 18  | 27  | 36  | 45  |
| 59  | 1'9416 | 9473  | 9530  | 9587  | 9645  | 9703  | 9762  | 9821  | 9880  | 9940  | 10 | 19  | 29  | 39  | 49  |
| 60  | 2'0000 | 0061  | 0122  | 0183  | 0245  | 0308  | 0371  | 0434  | 0498  | 0562  | 10 | 21  | 31  | 42  | 52  |
| 61  | 2'0627 | 0692  | 0757  | 0824  | 0890  | 0957  | 1025  | 1093  | 1162  | 1231  | 11 | 22  | 34  | 45  | 56  |
| 62  | 2'1301 | 1371  | 1441  | 1513  | 1584  | 1657  | 1730  | 1803  | 1877  | 1952  | 12 | 24  | 36  | 48  | 61  |
| 63  | 2'2027 | 2103  | 2179  | 2256  | 2333  | 2412  | 2490  | 2570  | 2650  | 2730  | 13 | 26  | 39  | 52  | 66  |
| 64  | 2'2812 | 2894  | 2976  | 3060  | 3144  | 3228  | 3314  | 3400  | 3486  | 3574  | 14 | 28  | 43  | 57  | 71  |
| 65  | 2'3662 | 3751  | 3841  | 3931  | 4022  | 4114  | 4207  | 4300  | 4395  | 4490  | 15 | 31  | 46  | 62  | 77  |
| 66  | 2'4586 | 4683  | 4780  | 4879  | 4978  | 5078  | 5180  | 5282  | 5384  | 5488  | 17 | 34  | 50  | 67  | 84  |
| 67  | 2'5593 | 5699  | 5805  | 5913  | 6022  | 6131  | 6242  | 6354  | 6466  | 6580  | 18 | 37  | 55  | 73  | 92  |
| 68  | 2'6695 | 6811  | 6927  | 7046  | 7165  | 7285  | 7407  | 7529  | 7653  | 7778  | 20 | 40  | 60  | 81  | 101 |
| 69  | 2'7904 | 8032  | 8161  | 8291  | 8422  | 8555  | 8688  | 8824  | 8960  | 9099  | 22 | 44  | 67  | 89  | 111 |
| 70  | 2'9238 | 9379  | 9521  | 9665  | 9811  | 9957  | 0106  | 0256  | 0407  | 0561  | 25 | 49  | 74  | 99  | 123 |
| 71  | 3'0716 | 0872  | 1030  | 1190  | 1352  | 1515  | 1681  | 1848  | 2017  | 2188  | 27 | 55  | 82  | 110 | 137 |
| 72  | 3'2361 | 2535  | 2712  | 2891  | 3072  | 3255  | 3440  | 3628  | 3817  | 4009  | 31 | 61  | 92  | 123 | 154 |
| 73  | 3'4203 | 4399  | 4598  | 4799  | 5003  | 5209  | 5418  | 5629  | 5843  | 6060  | 35 | 69  | 104 | 138 | 173 |
| 74  | 3'6280 | 6502  | 6727  | 6955  | 7186  | 7420  | 7657  | 7897  | 8140  | 8387  | 39 | 79  | 118 | 157 | 196 |
| 75  | 3'8637 | 8890  | 9147  | 9408  | 9672  | 9939  | 0211  | 0486  | 0765  | 1048  | 45 | 90  | 135 | 180 | 225 |
| 76  | 4'1336 | 1627  | 1923  | 2223  | 2527  | 2837  | 3150  | 3469  | 3792  | 4121  | 52 | 104 | 156 | 208 | 260 |
| 77  | 4'4454 | 4793  | 5137  | 5486  | 5841  | 6202  | 6569  | 6942  | 7321  | 7706  | 61 | 122 | 182 | 243 | 304 |
| 78  | 4'8097 | 8496  | 8901  | 9313  | 9732  | 0159  | 0593  | 1034  | 1484  | 1942  | 72 | 144 | 216 | 287 | 359 |
| 79  | 5'2408 | 2883  | 3367  | 3860  | 4362  | 4874  | 5396  | 5928  | 6470  | 7023  | 86 | 173 | 259 | 345 | 432 |
| 80  | 5'7588 | 8164  | 8751  | 9351  | 9963  | 0589  | 1227  | 1880  | 2546  | 3228  |    |     |     |     |     |
| 81  | 6'3925 | 4637  | 5366  | 6111  | 6874  | 7655  | 8454  | 9273  | 0112  | 0972  |    |     |     |     |     |
| 82  | 7'1853 | 2757  | 3684  | 4635  | 5611  | 6613  | 7642  | 8700  | 9787  | 0905  |    |     |     |     |     |
| 83  | 8'2055 | 3238  | 4457  | 5711  | 7004  | 8337  | 9711  | 1129  | 2593  | 4105  |    |     |     |     |     |
| 84  | 9'5668 | 7283  | 8955  | 0685  | 2477  | 4334  | 6261  | 8260  | 11'03 | 11'25 |    |     |     |     |     |
| 85  | 11'47  | 11'71 | 11'95 | 12'20 | 12'47 | 12'75 | 13'03 | 13'34 | 13'65 | 13'99 |    |     |     |     |     |
| 86  | 14'34  | 14'70 | 15'09 | 15'50 | 15'93 | 16'38 | 16'86 | 17'37 | 17'91 | 18'49 |    |     |     |     |     |
| 87  | 19'11  | 19'77 | 20'47 | 21'23 | 22'04 | 22'93 | 23'88 | 24'92 | 26'05 | 27'29 |    |     |     |     |     |
| 88  | 28'65  | 30'16 | 31'84 | 33'71 | 35'81 | 38'20 | 40'93 | 44'08 | 47'75 | 52'09 |    |     |     |     |     |
| 89  | 57'30  | 63'66 | 71'62 | 81'85 | 95'49 | 114'6 | 143'2 | 191'0 | 286'5 | 573'0 |    |     |     |     |     |

|    | 0'     | 6'    | 12'   | 18'   | 24'   | 30'   | 36'   | 42'   | 48'   | 54'   | 1  | 2   | 3   | 4   | 5   |
|----|--------|-------|-------|-------|-------|-------|-------|-------|-------|-------|----|-----|-----|-----|-----|
| 0° | Inf.   | 573°0 | 286°5 | 191°0 | 143°2 | 114°6 | 95°49 | 81°85 | 71°62 | 63°66 |    |     |     |     |     |
| 1  | 57°30  | 52°09 | 47°75 | 44°08 | 40°93 | 38°20 | 35°81 | 33°71 | 31°84 | 30°16 |    |     |     |     |     |
| 2  | 28°65  | 27°29 | 26°05 | 24°92 | 23°88 | 22°93 | 22°04 | 21°23 | 20°47 | 19°77 |    |     |     |     |     |
| 3  | 19°11  | 18°49 | 17°91 | 17°37 | 16°86 | 16°38 | 15°93 | 15°50 | 15°09 | 14°70 |    |     |     |     |     |
| 4  | 14°34  | 13°99 | 13°65 | 13°34 | 13°03 | 12°75 | 12°47 | 12°20 | 11°95 | 11°71 |    |     |     |     |     |
| 5  | 11°47  | 11°25 | 11°03 | 10°83 | 10°63 | 10°43 | 10°25 | 10°07 | 9°895 | 9°728 |    |     |     |     |     |
| 6  | 9°5668 | 4105  | 2593  | 1129  | 9711  | 8337  | 7004  | 5711  | 4457  | 3238  |    |     |     |     |     |
| 7  | 8°2055 | 0905  | 9787  | 8700  | 7642  | 6613  | 5611  | 4635  | 3684  | 2757  |    |     |     |     |     |
| 8  | 7°1853 | 0972  | 0112  | 9273  | 8454  | 7655  | 6874  | 6111  | 5366  | 4637  |    |     |     |     |     |
| 9  | 6°3925 | 3228  | 2546  | 1880  | 1227  | 0589  | 9963  | 9351  | 8751  | 8164  |    |     |     |     |     |
| 10 | 5°7588 | 7023  | 6470  | 5928  | 5396  | 4874  | 4362  | 3860  | 3367  | 2883  |    |     |     |     |     |
| 11 | 5°2408 | 1942  | 1484  | 1034  | 0593  | 0159  | 9732  | 9313  | 8901  | 8496  |    |     |     |     |     |
| 12 | 4°8097 | 7706  | 7321  | 6942  | 6569  | 6202  | 5841  | 5486  | 5137  | 4793  | 61 | 122 | 182 | 243 | 304 |
| 13 | 4°4454 | 4121  | 3792  | 3469  | 3150  | 2837  | 2527  | 2223  | 1923  | 1627  | 52 | 104 | 156 | 208 | 260 |
| 14 | 4°1336 | 1048  | 0765  | 0486  | 0211  | 9939  | 9672  | 9408  | 9147  | 8890  | 45 | 90  | 135 | 180 | 225 |
| 15 | 3°8637 | 8387  | 8140  | 7897  | 7657  | 7420  | 7186  | 6955  | 6727  | 6502  | 39 | 79  | 118 | 157 | 196 |
| 16 | 3°6280 | 6060  | 5843  | 5629  | 5418  | 5209  | 5003  | 4799  | 4598  | 4399  | 35 | 69  | 104 | 138 | 173 |
| 17 | 3°4203 | 4009  | 3817  | 3628  | 3440  | 3255  | 3072  | 2891  | 2712  | 2535  | 31 | 61  | 92  | 123 | 154 |
| 18 | 3°2361 | 2188  | 2017  | 1848  | 1681  | 1515  | 1352  | 1190  | 1030  | 0872  | 27 | 55  | 82  | 110 | 137 |
| 19 | 3°0716 | 0561  | 0407  | 0256  | 0106  | 9957  | 9811  | 9665  | 9521  | 9379  | 25 | 49  | 74  | 99  | 123 |
| 20 | 2°9238 | 9099  | 8960  | 8824  | 8688  | 8555  | 8422  | 8291  | 8161  | 8032  | 22 | 44  | 67  | 89  | 111 |
| 21 | 2°7904 | 7778  | 7653  | 7529  | 7407  | 7285  | 7165  | 7046  | 6927  | 6811  | 20 | 40  | 60  | 81  | 101 |
| 22 | 2°6695 | 6580  | 6466  | 6354  | 6242  | 6131  | 6022  | 5913  | 5805  | 5699  | 18 | 37  | 55  | 73  | 92  |
| 23 | 2°5593 | 5488  | 5384  | 5282  | 5180  | 5078  | 4978  | 4879  | 4780  | 4683  | 17 | 34  | 50  | 67  | 84  |
| 24 | 2°4586 | 4490  | 4395  | 4300  | 4207  | 4114  | 4022  | 3931  | 3841  | 3751  | 15 | 31  | 46  | 62  | 77  |
| 25 | 2°3662 | 3574  | 3486  | 3400  | 3314  | 3228  | 3144  | 3060  | 2976  | 2894  | 14 | 28  | 43  | 57  | 71  |
| 26 | 2°2812 | 2730  | 2650  | 2570  | 2490  | 2412  | 2333  | 2256  | 2179  | 2103  | 13 | 26  | 39  | 52  | 65  |
| 27 | 2°2027 | 1952  | 1877  | 1803  | 1730  | 1657  | 1584  | 1513  | 1441  | 1371  | 12 | 24  | 36  | 48  | 60  |
| 28 | 2°1301 | 1231  | 1162  | 1093  | 1025  | 0957  | 0890  | 0824  | 0757  | 0692  | 11 | 22  | 34  | 45  | 56  |
| 29 | 2°0627 | 0562  | 0498  | 0434  | 0371  | 0308  | 0245  | 0183  | 0122  | 0061  | 10 | 21  | 31  | 42  | 52  |
| 30 | 2°0000 | 9940  | 9880  | 9821  | 9762  | 9703  | 9645  | 9587  | 9530  | 9473  | 10 | 19  | 29  | 39  | 49  |
| 31 | 1°9416 | 9360  | 9304  | 9249  | 9194  | 9139  | 9084  | 9031  | 8977  | 8924  | 9  | 18  | 27  | 36  | 45  |
| 32 | 1°8871 | 8818  | 8766  | 8714  | 8663  | 8612  | 8561  | 8510  | 8460  | 8410  | 8  | 17  | 25  | 34  | 42  |
| 33 | 1°8361 | 8312  | 8263  | 8214  | 8166  | 8118  | 8070  | 8023  | 7976  | 7929  | 8  | 16  | 24  | 32  | 40  |
| 34 | 1°7883 | 7837  | 7791  | 7745  | 7700  | 7655  | 7610  | 7566  | 7522  | 7478  | 7  | 15  | 22  | 30  | 37  |
| 35 | 1°7434 | 7391  | 7348  | 7305  | 7263  | 7221  | 7179  | 7137  | 7095  | 7054  | 7  | 14  | 21  | 28  | 35  |
| 36 | 1°7013 | 6972  | 6932  | 6892  | 6852  | 6812  | 6772  | 6733  | 6694  | 6655  | 7  | 13  | 20  | 26  | 33  |
| 37 | 1°6616 | 6578  | 6540  | 6502  | 6464  | 6427  | 6390  | 6353  | 6316  | 6279  | 6  | 12  | 19  | 25  | 31  |
| 38 | 1°6243 | 6207  | 6171  | 6135  | 6099  | 6064  | 6029  | 5994  | 5959  | 5925  | 6  | 12  | 18  | 23  | 29  |
| 39 | 1°5890 | 5856  | 5822  | 5788  | 5755  | 5721  | 5688  | 5655  | 5622  | 5590  | 6  | 11  | 17  | 22  | 28  |
| 40 | 1°5557 | 5525  | 5493  | 5461  | 5429  | 5398  | 5366  | 5335  | 5304  | 5273  | 5  | 10  | 16  | 21  | 26  |
| 41 | 1°5243 | 5212  | 5182  | 5151  | 5121  | 5092  | 5062  | 5032  | 5003  | 4974  | 5  | 10  | 15  | 20  | 25  |
| 42 | 1°4945 | 4916  | 4887  | 4859  | 4830  | 4802  | 4774  | 4746  | 4718  | 4690  | 5  | 9   | 14  | 19  | 23  |
| 43 | 1°4663 | 4635  | 4608  | 4581  | 4554  | 4527  | 4501  | 4474  | 4448  | 4422  | 4  | 9   | 13  | 18  | 22  |
| 44 | 1°4396 | 4370  | 4344  | 4318  | 4293  | 4267  | 4242  | 4217  | 4192  | 4167  | 4  | 8   | 13  | 17  | 21  |

N.B.—Numbers in difference columns to be subtracted, not added.—See Rules.

|     | 0      | 6'   | 12'  | 18'  | 24'  | 30'  | 36'  | 42'  | 48'  | 54'  | 1 | 2 | 3  | 4  | 5  |
|-----|--------|------|------|------|------|------|------|------|------|------|---|---|----|----|----|
| 45° | 1'4142 | 4118 | 4093 | 4069 | 4044 | 4020 | 3996 | 3972 | 3949 | 3925 | 4 | 8 | 12 | 16 | 20 |
| 46  | 1'3902 | 3878 | 3855 | 3832 | 3809 | 3786 | 3763 | 3741 | 3718 | 3696 | 4 | 8 | 11 | 15 | 19 |
| 47  | 1'3673 | 3651 | 3629 | 3607 | 3585 | 3563 | 3542 | 3520 | 3499 | 3478 | 4 | 7 | 11 | 14 | 18 |
| 48  | 1'3456 | 3435 | 3414 | 3393 | 3373 | 3352 | 3331 | 3311 | 3291 | 3270 | 3 | 7 | 10 | 14 | 17 |
| 49  | 1'3250 | 3230 | 3210 | 3190 | 3171 | 3151 | 3131 | 3112 | 3093 | 3073 | 3 | 7 | 10 | 13 | 16 |
| 50  | 1'3054 | 3035 | 3016 | 2997 | 2978 | 2960 | 2941 | 2923 | 2904 | 2886 | 3 | 6 | 9  | 12 | 15 |
| 51  | 1'2868 | 2849 | 2831 | 2813 | 2796 | 2778 | 2760 | 2742 | 2725 | 2708 | 3 | 6 | 9  | 12 | 15 |
| 52  | 1'2690 | 2673 | 2656 | 2639 | 2622 | 2605 | 2588 | 2571 | 2554 | 2538 | 3 | 6 | 8  | 11 | 14 |
| 53  | 1'2521 | 2505 | 2489 | 2472 | 2456 | 2440 | 2424 | 2408 | 2392 | 2376 | 3 | 5 | 8  | 11 | 13 |
| 54  | 1'2361 | 2345 | 2329 | 2314 | 2299 | 2283 | 2268 | 2253 | 2238 | 2223 | 3 | 5 | 8  | 10 | 13 |
| 55  | 1'2208 | 2193 | 2178 | 2163 | 2149 | 2134 | 2120 | 2105 | 2091 | 2076 | 2 | 5 | 7  | 10 | 12 |
| 56  | 1'2062 | 2048 | 2034 | 2020 | 2006 | 1992 | 1978 | 1964 | 1951 | 1937 | 2 | 5 | 7  | 9  | 12 |
| 57  | 1'1924 | 1910 | 1897 | 1883 | 1870 | 1857 | 1844 | 1831 | 1818 | 1805 | 2 | 4 | 7  | 9  | 11 |
| 58  | 1'1792 | 1779 | 1766 | 1753 | 1741 | 1728 | 1716 | 1703 | 1691 | 1679 | 2 | 4 | 6  | 8  | 10 |
| 59  | 1'1666 | 1654 | 1642 | 1630 | 1618 | 1606 | 1594 | 1582 | 1570 | 1559 | 2 | 4 | 6  | 8  | 10 |
| 60  | 1'1547 | 1535 | 1524 | 1512 | 1501 | 1490 | 1478 | 1467 | 1456 | 1445 | 2 | 4 | 6  | 8  | 9  |
| 61  | 1'1434 | 1423 | 1412 | 1401 | 1390 | 1379 | 1368 | 1357 | 1347 | 1336 | 2 | 4 | 5  | 7  | 9  |
| 62  | 1'1326 | 1315 | 1305 | 1294 | 1284 | 1274 | 1264 | 1253 | 1243 | 1233 | 2 | 3 | 5  | 7  | 9  |
| 63  | 1'1223 | 1213 | 1203 | 1194 | 1184 | 1174 | 1164 | 1155 | 1145 | 1136 | 2 | 3 | 5  | 6  | 8  |
| 64  | 1'1126 | 1117 | 1107 | 1098 | 1089 | 1079 | 1070 | 1061 | 1052 | 1043 | 2 | 3 | 5  | 6  | 8  |
| 65  | 1'1034 | 1025 | 1016 | 1007 | 0998 | 0989 | 0981 | 0972 | 0963 | 0955 | 1 | 3 | 4  | 6  | 7  |
| 66  | 1'0946 | 0938 | 0929 | 0921 | 0913 | 0904 | 0896 | 0888 | 0880 | 0872 | 1 | 3 | 4  | 6  | 7  |
| 67  | 1'0864 | 0856 | 0848 | 0840 | 0832 | 0824 | 0816 | 0808 | 0801 | 0793 | 1 | 3 | 4  | 5  | 7  |
| 68  | 1'0785 | 0778 | 0770 | 0763 | 0755 | 0748 | 0740 | 0733 | 0726 | 0719 | 1 | 2 | 4  | 5  | 6  |
| 69  | 1'0711 | 0704 | 0697 | 0690 | 0683 | 0676 | 0669 | 0662 | 0655 | 0649 | 1 | 2 | 3  | 5  | 6  |
| 70  | 1'0642 | 0635 | 0628 | 0622 | 0615 | 0608 | 0602 | 0595 | 0589 | 0583 | 1 | 2 | 3  | 4  | 5  |
| 71  | 1'0576 | 0570 | 0564 | 0557 | 0551 | 0545 | 0539 | 0533 | 0527 | 0521 | 1 | 2 | 3  | 4  | 5  |
| 72  | 1'0515 | 0509 | 0503 | 0497 | 0491 | 0485 | 0480 | 0474 | 0468 | 0463 | 1 | 2 | 3  | 4  | 5  |
| 73  | 1'0457 | 0451 | 0446 | 0440 | 0435 | 0429 | 0424 | 0419 | 0413 | 0408 | 1 | 2 | 3  | 4  | 4  |
| 74  | 1'0403 | 0398 | 0393 | 0388 | 0382 | 0377 | 0372 | 0367 | 0363 | 0358 | 1 | 2 | 2  | 3  | 4  |
| 75  | 1'0353 | 0348 | 0343 | 0338 | 0334 | 0329 | 0324 | 0320 | 0315 | 0311 | 1 | 2 | 2  | 3  | 4  |
| 76  | 1'0306 | 0302 | 0297 | 0293 | 0288 | 0284 | 0280 | 0276 | 0271 | 0267 | 1 | 1 | 2  | 3  | 4  |
| 77  | 1'0263 | 0259 | 0255 | 0251 | 0247 | 0243 | 0239 | 0235 | 0231 | 0227 | 1 | 1 | 2  | 3  | 3  |
| 78  | 1'0223 | 0220 | 0216 | 0212 | 0209 | 0205 | 0201 | 0198 | 0194 | 0191 | 1 | 1 | 2  | 3  | 3  |
| 79  | 1'0187 | 0184 | 0180 | 0177 | 0174 | 0170 | 0167 | 0164 | 0161 | 0157 | 1 | 1 | 2  | 2  | 3  |
| 80  | 1'0154 | 0151 | 0148 | 0145 | 0142 | 0139 | 0136 | 0133 | 0130 | 0127 | 0 | 1 | 1  | 2  | 2  |
| 81  | 1'0125 | 0122 | 0119 | 0116 | 0114 | 0111 | 0108 | 0106 | 0103 | 0101 | 0 | 1 | 1  | 2  | 2  |
| 82  | 1'0098 | 0096 | 0093 | 0091 | 0089 | 0086 | 0084 | 0082 | 0079 | 0077 | 0 | 1 | 1  | 2  | 2  |
| 83  | 1'0075 | 0073 | 0071 | 0069 | 0067 | 0065 | 0063 | 0061 | 0059 | 0057 | 0 | 1 | 1  | 1  | 2  |
| 84  | 1'0055 | 0053 | 0051 | 0050 | 0048 | 0046 | 0045 | 0043 | 0041 | 0040 | 0 | 1 | 1  | 1  | 1  |
| 85  | 1'0038 | 0037 | 0035 | 0034 | 0032 | 0031 | 0030 | 0028 | 0027 | 0026 | 0 | 0 | 1  | 1  | 1  |
| 86  | 1'0024 | 0023 | 0022 | 0021 | 0020 | 0019 | 0018 | 0017 | 0016 | 0015 | 0 | 0 | 0  | 1  | 1  |
| 87  | 1'0014 | 0013 | 0012 | 0011 | 0010 | 0010 | 0009 | 0008 | 0007 | 0007 | 0 | 0 | 0  | 1  | 1  |
| 88  | 1'0006 | 0006 | 0005 | 0004 | 0004 | 0003 | 0003 | 0003 | 0002 | 0002 | 0 | 0 | 0  | 0  | 0  |
| 89  | 1'0002 | 0001 | 0001 | 0001 | 0001 | 0000 | 0000 | 0000 | 0000 | 0000 | 0 | 0 | 0  | 0  | 0  |

N.B.—Numbers in difference columns to be subtracted, not added.—See Rules.



|    | 0'     | 6'   | 12'  | 18'  | 24'  | 30'  | 36'  | 42'  | 48'  | 54'  | 1 | 2 | 3 | 4  | 5  |
|----|--------|------|------|------|------|------|------|------|------|------|---|---|---|----|----|
| 0° | 0°0000 | 0017 | 0035 | 0052 | 0070 | 0087 | 0105 | 0122 | 0140 | 0157 | 3 | 6 | 9 | 12 | 15 |
| 1  | 0°0175 | 0192 | 0209 | 0227 | 0244 | 0262 | 0279 | 0297 | 0314 | 0332 | 3 | 6 | 9 | 12 | 15 |
| 2  | 0°0349 | 0367 | 0384 | 0401 | 0419 | 0436 | 0454 | 0471 | 0489 | 0506 | 3 | 6 | 9 | 12 | 15 |
| 3  | 0°0524 | 0541 | 0559 | 0576 | 0593 | 0611 | 0628 | 0646 | 0663 | 0681 | 3 | 6 | 9 | 12 | 15 |
| 4  | 0°0698 | 0716 | 0733 | 0750 | 0768 | 0785 | 0803 | 0820 | 0838 | 0855 | 3 | 6 | 9 | 12 | 15 |
| 5  | 0°0873 | 0890 | 0908 | 0925 | 0942 | 0960 | 0977 | 0995 | 1012 | 1030 | 3 | 6 | 9 | 12 | 15 |
| 6  | 0°1047 | 1065 | 1082 | 1100 | 1117 | 1134 | 1152 | 1169 | 1187 | 1204 | 3 | 6 | 9 | 12 | 15 |
| 7  | 0°1222 | 1239 | 1257 | 1274 | 1292 | 1309 | 1326 | 1344 | 1361 | 1379 | 3 | 6 | 9 | 12 | 15 |
| 8  | 0°1396 | 1414 | 1431 | 1449 | 1466 | 1484 | 1501 | 1518 | 1536 | 1553 | 3 | 6 | 9 | 12 | 15 |
| 9  | 0°1571 | 1588 | 1606 | 1623 | 1641 | 1658 | 1676 | 1693 | 1710 | 1728 | 3 | 6 | 9 | 12 | 15 |
| 10 | 0°1745 | 1763 | 1780 | 1798 | 1815 | 1833 | 1850 | 1868 | 1885 | 1902 | 3 | 6 | 9 | 12 | 15 |
| 11 | 0°1920 | 1937 | 1955 | 1972 | 1990 | 2007 | 2025 | 2042 | 2059 | 2077 | 3 | 6 | 9 | 12 | 15 |
| 12 | 0°2094 | 2112 | 2129 | 2147 | 2164 | 2182 | 2199 | 2217 | 2234 | 2251 | 3 | 6 | 9 | 12 | 15 |
| 13 | 0°2269 | 2286 | 2304 | 2321 | 2339 | 2356 | 2374 | 2391 | 2409 | 2426 | 3 | 6 | 9 | 12 | 15 |
| 14 | 0°2443 | 2461 | 2478 | 2496 | 2513 | 2531 | 2548 | 2566 | 2583 | 2601 | 3 | 6 | 9 | 12 | 15 |
| 15 | 0°2618 | 2635 | 2653 | 2670 | 2688 | 2705 | 2723 | 2740 | 2758 | 2775 | 3 | 6 | 9 | 12 | 15 |
| 16 | 0°2793 | 2810 | 2827 | 2845 | 2862 | 2880 | 2897 | 2915 | 2932 | 2950 | 3 | 6 | 9 | 12 | 15 |
| 17 | 0°2967 | 2985 | 3002 | 3019 | 3037 | 3054 | 3072 | 3089 | 3107 | 3124 | 3 | 6 | 9 | 12 | 15 |
| 18 | 0°3142 | 3159 | 3176 | 3194 | 3211 | 3229 | 3246 | 3264 | 3281 | 3299 | 3 | 6 | 9 | 12 | 15 |
| 19 | 0°3316 | 3334 | 3351 | 3368 | 3386 | 3403 | 3421 | 3438 | 3456 | 3473 | 3 | 6 | 9 | 12 | 15 |
| 20 | 0°3491 | 3508 | 3526 | 3543 | 3560 | 3578 | 3595 | 3613 | 3630 | 3648 | 3 | 6 | 9 | 12 | 15 |
| 21 | 0°3665 | 3683 | 3700 | 3718 | 3735 | 3752 | 3770 | 3787 | 3805 | 3822 | 3 | 6 | 9 | 12 | 15 |
| 22 | 0°3840 | 3857 | 3875 | 3892 | 3910 | 3927 | 3944 | 3962 | 3979 | 3997 | 3 | 6 | 9 | 12 | 15 |
| 23 | 0°4014 | 4032 | 4049 | 4067 | 4084 | 4102 | 4119 | 4136 | 4154 | 4171 | 3 | 6 | 9 | 12 | 15 |
| 24 | 0°4189 | 4206 | 4224 | 4241 | 4259 | 4276 | 4294 | 4311 | 4328 | 4346 | 3 | 6 | 9 | 12 | 15 |
| 25 | 0°4363 | 4381 | 4398 | 4416 | 4433 | 4451 | 4468 | 4485 | 4503 | 4520 | 3 | 6 | 9 | 12 | 15 |
| 26 | 0°4538 | 4555 | 4573 | 4590 | 4608 | 4625 | 4643 | 4660 | 4677 | 4695 | 3 | 6 | 9 | 12 | 15 |
| 27 | 0°4712 | 4730 | 4747 | 4765 | 4782 | 4800 | 4817 | 4835 | 4852 | 4869 | 3 | 6 | 9 | 12 | 15 |
| 28 | 0°4887 | 4904 | 4922 | 4939 | 4957 | 4974 | 4992 | 5009 | 5027 | 5044 | 3 | 6 | 9 | 12 | 15 |
| 29 | 0°5061 | 5079 | 5096 | 5114 | 5131 | 5149 | 5166 | 5184 | 5201 | 5219 | 3 | 6 | 9 | 12 | 15 |
| 30 | 0°5236 | 5253 | 5271 | 5288 | 5306 | 5323 | 5341 | 5358 | 5376 | 5393 | 3 | 6 | 9 | 12 | 15 |
| 31 | 0°5411 | 5428 | 5445 | 5463 | 5480 | 5498 | 5515 | 5533 | 5550 | 5568 | 3 | 6 | 9 | 12 | 15 |
| 32 | 0°5585 | 5603 | 5620 | 5637 | 5655 | 5672 | 5690 | 5707 | 5725 | 5742 | 3 | 6 | 9 | 12 | 15 |
| 33 | 0°5760 | 5777 | 5794 | 5812 | 5829 | 5847 | 5864 | 5882 | 5899 | 5917 | 3 | 6 | 9 | 12 | 15 |
| 34 | 0°5934 | 5952 | 5969 | 5986 | 6004 | 6021 | 6039 | 6056 | 6074 | 6091 | 3 | 6 | 9 | 12 | 15 |
| 35 | 0°6109 | 6126 | 6144 | 6161 | 6178 | 6196 | 6213 | 6231 | 6248 | 6266 | 3 | 6 | 9 | 12 | 15 |
| 36 | 0°6283 | 6301 | 6318 | 6336 | 6353 | 6370 | 6388 | 6405 | 6423 | 6440 | 3 | 6 | 9 | 12 | 15 |
| 37 | 0°6458 | 6475 | 6493 | 6510 | 6528 | 6545 | 6562 | 6580 | 6597 | 6615 | 3 | 6 | 9 | 12 | 15 |
| 38 | 0°6632 | 6650 | 6667 | 6685 | 6702 | 6720 | 6737 | 6754 | 6772 | 6789 | 3 | 6 | 9 | 12 | 15 |
| 39 | 0°6807 | 6824 | 6842 | 6859 | 6877 | 6894 | 6912 | 6929 | 6946 | 6964 | 3 | 6 | 9 | 12 | 15 |
| 40 | 0°6981 | 6999 | 7016 | 7034 | 7051 | 7069 | 7086 | 7103 | 7121 | 7138 | 3 | 6 | 9 | 12 | 15 |
| 41 | 0°7156 | 7173 | 7191 | 7208 | 7226 | 7243 | 7261 | 7278 | 7295 | 7313 | 3 | 6 | 9 | 12 | 15 |
| 42 | 0°7330 | 7348 | 7365 | 7383 | 7400 | 7418 | 7435 | 7453 | 7470 | 7487 | 3 | 6 | 9 | 12 | 15 |
| 43 | 0°7505 | 7522 | 7540 | 7557 | 7575 | 7592 | 7610 | 7627 | 7645 | 7662 | 3 | 6 | 9 | 12 | 15 |
| 44 | 0°7679 | 7697 | 7714 | 7732 | 7749 | 7767 | 7784 | 7802 | 7819 | 7837 | 3 | 6 | 9 | 12 | 15 |



|     | 0'     | 6'   | 12'  | 18'  | 24'  | 30'  | 36'  | 42'  | 48'  | 54'  | 1 | 2 | 3 | 4  | 5  |
|-----|--------|------|------|------|------|------|------|------|------|------|---|---|---|----|----|
| 45° | 0.7854 | 7871 | 7889 | 7906 | 7924 | 7941 | 7959 | 7976 | 7994 | 8011 | 3 | 6 | 9 | 12 | 15 |
| 46  | 0.8029 | 8046 | 8063 | 8081 | 8098 | 8116 | 8133 | 8151 | 8168 | 8186 | 3 | 6 | 9 | 12 | 15 |
| 47  | 0.8203 | 8221 | 8238 | 8255 | 8273 | 8290 | 8308 | 8325 | 8343 | 8360 | 3 | 6 | 9 | 12 | 15 |
| 48  | 0.8378 | 8395 | 8412 | 8430 | 8447 | 8465 | 8482 | 8500 | 8517 | 8535 | 3 | 6 | 9 | 12 | 15 |
| 49  | 0.8552 | 8570 | 8587 | 8604 | 8622 | 8639 | 8657 | 8674 | 8692 | 8709 | 3 | 6 | 9 | 12 | 15 |
| 50  | 0.8727 | 8744 | 8762 | 8779 | 8796 | 8814 | 8831 | 8849 | 8866 | 8884 | 3 | 6 | 9 | 12 | 15 |
| 51  | 0.8901 | 8919 | 8936 | 8954 | 8971 | 8988 | 9006 | 9023 | 9041 | 9058 | 3 | 6 | 9 | 12 | 15 |
| 52  | 0.9076 | 9093 | 9111 | 9128 | 9146 | 9163 | 9180 | 9198 | 9215 | 9233 | 3 | 6 | 9 | 12 | 15 |
| 53  | 0.9250 | 9268 | 9285 | 9303 | 9320 | 9338 | 9355 | 9372 | 9390 | 9407 | 3 | 6 | 9 | 12 | 15 |
| 54  | 0.9425 | 9442 | 9460 | 9477 | 9495 | 9512 | 9529 | 9547 | 9564 | 9582 | 3 | 6 | 9 | 12 | 15 |
| 55  | 0.9599 | 9617 | 9634 | 9652 | 9669 | 9687 | 9704 | 9721 | 9739 | 9756 | 3 | 6 | 9 | 12 | 15 |
| 56  | 0.9774 | 9791 | 9809 | 9826 | 9844 | 9861 | 9879 | 9896 | 9913 | 9931 | 3 | 6 | 9 | 12 | 15 |
| 57  | 0.9948 | 9966 | 9983 | 0001 | 0018 | 0036 | 0053 | 0071 | 0088 | 0105 | 3 | 6 | 9 | 12 | 15 |
| 58  | 1.0123 | 0140 | 0158 | 0175 | 0193 | 0210 | 0228 | 0245 | 0263 | 0280 | 3 | 6 | 9 | 12 | 15 |
| 59  | 1.0297 | 0315 | 0332 | 0350 | 0367 | 0385 | 0402 | 0420 | 0437 | 0455 | 3 | 6 | 9 | 12 | 15 |
| 60  | 1.0472 | 0489 | 0507 | 0524 | 0542 | 0559 | 0577 | 0594 | 0612 | 0629 | 3 | 6 | 9 | 12 | 15 |
| 61  | 1.0647 | 0664 | 0681 | 0699 | 0716 | 0734 | 0751 | 0769 | 0786 | 0804 | 3 | 6 | 9 | 12 | 15 |
| 62  | 1.0821 | 0838 | 0856 | 0873 | 0891 | 0908 | 0926 | 0943 | 0961 | 0978 | 3 | 6 | 9 | 12 | 15 |
| 63  | 1.0996 | 1013 | 1030 | 1048 | 1065 | 1083 | 1100 | 1118 | 1135 | 1153 | 3 | 6 | 9 | 12 | 15 |
| 64  | 1.1170 | 1188 | 1205 | 1222 | 1240 | 1257 | 1275 | 1292 | 1310 | 1327 | 3 | 6 | 9 | 12 | 15 |
| 65  | 1.1345 | 1362 | 1380 | 1397 | 1414 | 1432 | 1449 | 1467 | 1484 | 1502 | 3 | 6 | 9 | 12 | 15 |
| 66  | 1.1519 | 1537 | 1554 | 1572 | 1589 | 1606 | 1624 | 1641 | 1659 | 1676 | 3 | 6 | 9 | 12 | 15 |
| 67  | 1.1694 | 1711 | 1729 | 1746 | 1764 | 1781 | 1798 | 1816 | 1833 | 1851 | 3 | 6 | 9 | 12 | 15 |
| 68  | 1.1868 | 1886 | 1903 | 1921 | 1938 | 1956 | 1973 | 1990 | 2008 | 2025 | 3 | 6 | 9 | 12 | 15 |
| 69  | 1.2043 | 2060 | 2078 | 2095 | 2113 | 2130 | 2147 | 2165 | 2182 | 2200 | 3 | 6 | 9 | 12 | 15 |
| 70  | 1.2217 | 2235 | 2252 | 2270 | 2287 | 2305 | 2322 | 2339 | 2357 | 2374 | 3 | 6 | 9 | 12 | 15 |
| 71  | 1.2392 | 2409 | 2427 | 2444 | 2462 | 2479 | 2497 | 2514 | 2531 | 2549 | 3 | 6 | 9 | 12 | 15 |
| 72  | 1.2566 | 2584 | 2601 | 2619 | 2636 | 2654 | 2671 | 2689 | 2706 | 2723 | 3 | 6 | 9 | 12 | 15 |
| 73  | 1.2741 | 2758 | 2776 | 2793 | 2811 | 2828 | 2846 | 2863 | 2881 | 2898 | 3 | 6 | 9 | 12 | 15 |
| 74  | 1.2915 | 2933 | 2950 | 2968 | 2985 | 3003 | 3020 | 3038 | 3055 | 3073 | 3 | 6 | 9 | 12 | 15 |
| 75  | 1.3090 | 3107 | 3125 | 3142 | 3160 | 3177 | 3195 | 3212 | 3230 | 3247 | 3 | 6 | 9 | 12 | 15 |
| 76  | 1.3265 | 3282 | 3299 | 3317 | 3334 | 3352 | 3369 | 3387 | 3404 | 3422 | 3 | 6 | 9 | 12 | 15 |
| 77  | 1.3439 | 3456 | 3474 | 3491 | 3509 | 3526 | 3544 | 3561 | 3579 | 3596 | 3 | 6 | 9 | 12 | 15 |
| 78  | 1.3614 | 3631 | 3648 | 3666 | 3683 | 3701 | 3718 | 3736 | 3753 | 3771 | 3 | 6 | 9 | 12 | 15 |
| 79  | 1.3788 | 3806 | 3823 | 3840 | 3858 | 3875 | 3893 | 3910 | 3928 | 3945 | 3 | 6 | 9 | 12 | 15 |
| 80  | 1.3963 | 3980 | 3998 | 4015 | 4032 | 4050 | 4067 | 4085 | 4102 | 4120 | 3 | 6 | 9 | 12 | 15 |
| 81  | 1.4137 | 4155 | 4172 | 4190 | 4207 | 4224 | 4242 | 4259 | 4277 | 4294 | 3 | 6 | 9 | 12 | 15 |
| 82  | 1.4312 | 4329 | 4347 | 4364 | 4382 | 4399 | 4416 | 4434 | 4451 | 4469 | 3 | 6 | 9 | 12 | 15 |
| 83  | 1.4486 | 4504 | 4521 | 4539 | 4556 | 4573 | 4591 | 4608 | 4626 | 4643 | 3 | 6 | 9 | 12 | 15 |
| 84  | 1.4661 | 4678 | 4696 | 4713 | 4731 | 4748 | 4765 | 4783 | 4800 | 4818 | 3 | 6 | 9 | 12 | 15 |
| 85  | 1.4835 | 4853 | 4870 | 4888 | 4905 | 4923 | 4940 | 4957 | 4975 | 4992 | 3 | 6 | 9 | 12 | 15 |
| 86  | 1.5010 | 5027 | 5045 | 5062 | 5080 | 5097 | 5115 | 5132 | 5149 | 5167 | 3 | 6 | 9 | 12 | 15 |
| 87  | 1.5184 | 5202 | 5219 | 5237 | 5254 | 5272 | 5289 | 5307 | 5324 | 5341 | 3 | 6 | 9 | 12 | 15 |
| 88  | 1.5359 | 5376 | 5394 | 5411 | 5429 | 5446 | 5464 | 5481 | 5499 | 5516 | 3 | 6 | 9 | 12 | 15 |
| 89  | 1.5533 | 5551 | 5568 | 5586 | 5603 | 5621 | 5638 | 5656 | 5673 | 5691 | 3 | 6 | 9 | 12 | 15 |

|     | 0     | 1     | 2     | 3     | 4     | 5     | 6     | 7     | 8     | 9     | 1 2 3   | 4 5 6    | 7 8 9    |
|-----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|---------|----------|----------|
| 1'0 | 1'000 | 1'020 | 1'040 | 1'061 | 1'082 | 1'103 | 1'124 | 1'145 | 1'166 | 1'188 | 2 4 6   | 8 10 13  | 15 17 19 |
| 1'1 | 1'210 | 1'232 | 1'254 | 1'277 | 1'300 | 1'323 | 1'346 | 1'369 | 1'392 | 1'416 | 2 5 7   | 9 11 14  | 16 18 21 |
| 1'2 | 1'440 | 1'464 | 1'488 | 1'513 | 1'538 | 1'563 | 1'588 | 1'613 | 1'638 | 1'664 | 2 5 7   | 10 12 15 | 17 20 22 |
| 1'3 | 1'690 | 1'716 | 1'742 | 1'769 | 1'796 | 1'823 | 1'850 | 1'877 | 1'904 | 1'932 | 3 5 8   | 11 13 16 | 19 22 24 |
| 1'4 | 1'960 | 1'988 | 2'016 | 2'045 | 2'074 | 2'103 | 2'132 | 2'161 | 2'190 | 2'220 | 3 6 9   | 12 14 17 | 20 23 26 |
| 1'5 | 2'250 | 2'280 | 2'310 | 2'341 | 2'372 | 2'403 | 2'434 | 2'465 | 2'496 | 2'528 | 3 6 9   | 12 15 19 | 22 25 28 |
| 1'6 | 2'560 | 2'592 | 2'624 | 2'657 | 2'690 | 2'723 | 2'756 | 2'789 | 2'822 | 2'856 | 3 7 10  | 13 16 20 | 23 26 30 |
| 1'7 | 2'890 | 2'924 | 2'958 | 2'993 | 3'028 | 3'063 | 3'098 | 3'133 | 3'168 | 3'204 | 3 7 10  | 14 17 21 | 24 28 31 |
| 1'8 | 3'240 | 3'276 | 3'312 | 3'349 | 3'386 | 3'423 | 3'460 | 3'497 | 3'534 | 3'572 | 4 7 11  | 15 18 22 | 26 30 33 |
| 1'9 | 3'610 | 3'648 | 3'686 | 3'725 | 3'764 | 3'803 | 3'842 | 3'881 | 3'920 | 3'960 | 4 8 12  | 16 19 23 | 27 31 35 |
| 2'0 | 4'000 | 4'040 | 4'080 | 4'121 | 4'162 | 4'203 | 4'244 | 4'285 | 4'326 | 4'368 | 4 8 12  | 16 20 25 | 29 33 37 |
| 2'1 | 4'410 | 4'452 | 4'494 | 4'537 | 4'580 | 4'623 | 4'666 | 4'709 | 4'752 | 4'796 | 4 9 13  | 17 21 26 | 30 34 39 |
| 2'2 | 4'840 | 4'884 | 4'928 | 4'973 | 5'018 | 5'063 | 5'108 | 5'153 | 5'198 | 5'244 | 4 9 13  | 18 22 27 | 31 36 40 |
| 2'3 | 5'290 | 5'336 | 5'382 | 5'429 | 5'476 | 5'523 | 5'570 | 5'617 | 5'664 | 5'712 | 5 9 14  | 19 23 28 | 33 38 42 |
| 2'4 | 5'760 | 5'808 | 5'856 | 5'905 | 5'954 | 6'003 | 6'052 | 6'101 | 6'150 | 6'200 | 5 10 15 | 20 24 29 | 34 39 44 |
| 2'5 | 6'250 | 6'300 | 6'350 | 6'401 | 6'452 | 6'503 | 6'554 | 6'605 | 6'656 | 6'708 | 5 10 15 | 20 25 31 | 36 41 46 |
| 2'6 | 6'760 | 6'812 | 6'864 | 6'917 | 6'970 | 7'023 | 7'076 | 7'129 | 7'182 | 7'236 | 5 11 16 | 21 26 32 | 37 42 48 |
| 2'7 | 7'290 | 7'344 | 7'398 | 7'453 | 7'508 | 7'563 | 7'618 | 7'673 | 7'728 | 7'784 | 5 11 16 | 22 27 33 | 38 44 49 |
| 2'8 | 7'840 | 7'896 | 7'952 | 8'009 | 8'066 | 8'123 | 8'180 | 8'237 | 8'294 | 8'352 | 6 11 17 | 23 28 34 | 40 46 51 |
| 2'9 | 8'410 | 8'468 | 8'526 | 8'585 | 8'644 | 8'703 | 8'762 | 8'821 | 8'880 | 8'940 | 6 12 18 | 24 29 35 | 41 47 53 |
| 3'0 | 9'000 | 9'060 | 9'120 | 9'181 | 9'242 | 9'303 | 9'364 | 9'425 | 9'486 | 9'548 | 6 12 18 | 24 30 37 | 43 49 55 |
| 3'1 | 9'610 | 9'672 | 9'734 | 9'797 | 9'860 | 9'923 | 9'986 |       |       |       | 6 13 19 | 25 31 38 | 44 50 57 |
| 3'1 |       |       |       |       |       |       |       | 10'05 | 10'11 | 10'18 | 1 1 2   | 3 3 4    | 5 5 6    |
| 3'2 | 10'24 | 10'30 | 10'37 | 10'43 | 10'50 | 10'56 | 10'63 | 10'69 | 10'76 | 10'82 | 1 1 2   | 3 3 4    | 5 5 6    |
| 3'3 | 10'89 | 10'96 | 11'02 | 11'09 | 11'16 | 11'22 | 11'29 | 11'36 | 11'42 | 11'49 | 1 1 2   | 3 3 4    | 5 5 6    |
| 3'4 | 11'56 | 11'63 | 11'70 | 11'76 | 11'83 | 11'90 | 11'97 | 12'04 | 12'11 | 12'18 | 1 1 2   | 3 3 4    | 5 6 6    |
| 3'5 | 12'25 | 12'32 | 12'39 | 12'46 | 12'53 | 12'60 | 12'67 | 12'74 | 12'82 | 12'89 | 1 1 2   | 3 4 4    | 5 6 6    |
| 3'6 | 12'96 | 13'03 | 13'10 | 13'18 | 13'25 | 13'32 | 13'40 | 13'47 | 13'54 | 13'62 | 1 1 2   | 3 4 4    | 5 6 7    |
| 3'7 | 13'69 | 13'76 | 13'84 | 13'91 | 13'99 | 14'06 | 14'14 | 14'21 | 14'29 | 14'36 | 1 2 2   | 3 4 5    | 5 6 7    |
| 3'8 | 14'44 | 14'52 | 14'59 | 14'67 | 14'75 | 14'82 | 14'90 | 14'98 | 15'05 | 15'13 | 1 2 2   | 3 4 5    | 5 6 7    |
| 3'9 | 15'21 | 15'29 | 15'37 | 15'44 | 15'52 | 15'60 | 15'68 | 15'76 | 15'84 | 15'92 | 1 2 2   | 3 4 5    | 6 6 7    |
| 4'0 | 16'00 | 16'08 | 16'16 | 16'24 | 16'32 | 16'40 | 16'48 | 16'56 | 16'65 | 16'73 | 1 2 2   | 3 4 5    | 6 6 7    |
| 4'1 | 16'81 | 16'89 | 16'97 | 17'06 | 17'14 | 17'22 | 17'31 | 17'39 | 17'47 | 17'56 | 1 2 2   | 3 4 5    | 6 7 7    |
| 4'2 | 17'64 | 17'72 | 17'81 | 17'89 | 17'98 | 18'06 | 18'15 | 18'23 | 18'32 | 18'40 | 1 2 3   | 3 4 5    | 6 7 8    |
| 4'3 | 18'49 | 18'58 | 18'66 | 18'75 | 18'84 | 18'92 | 19'01 | 19'10 | 19'18 | 19'27 | 1 2 3   | 3 4 5    | 6 7 8    |
| 4'4 | 19'36 | 19'45 | 19'54 | 19'62 | 19'71 | 19'80 | 19'89 | 19'98 | 20'07 | 20'16 | 1 2 3   | 4 5 5    | 6 7 8    |
| 4'5 | 20'25 | 20'34 | 20'43 | 20'52 | 20'61 | 20'70 | 20'79 | 20'88 | 20'98 | 21'07 | 1 2 3   | 4 5 5    | 6 7 8    |
| 4'6 | 21'16 | 21'25 | 21'34 | 21'44 | 21'53 | 21'62 | 21'72 | 21'81 | 21'90 | 22'00 | 1 2 3   | 4 5 6    | 7 7 8    |
| 4'7 | 22'09 | 22'18 | 22'28 | 22'37 | 22'47 | 22'56 | 22'66 | 22'75 | 22'85 | 22'94 | 1 2 3   | 4 5 6    | 7 8 9    |
| 4'8 | 23'04 | 23'14 | 23'23 | 23'33 | 23'43 | 23'52 | 23'62 | 23'72 | 23'81 | 23'91 | 1 2 3   | 4 5 6    | 7 8 9    |
| 4'9 | 24'01 | 24'11 | 24'21 | 24'30 | 24'40 | 24'50 | 24'60 | 24'70 | 24'80 | 24'90 | 1 2 3   | 4 5 6    | 7 8 9    |
| 5'0 | 25'00 | 25'10 | 25'20 | 25'30 | 25'40 | 25'50 | 25'60 | 25'70 | 25'81 | 25'91 | 1 2 3   | 4 5 6    | 7 8 9    |
| 5'1 | 26'01 | 26'11 | 26'21 | 26'32 | 26'42 | 26'52 | 26'63 | 26'73 | 26'83 | 26'94 | 1 2 3   | 4 5 6    | 7 8 9    |
| 5'2 | 27'04 | 27'14 | 27'25 | 27'35 | 27'46 | 27'56 | 27'67 | 27'77 | 27'88 | 27'98 | 1 2 3   | 4 5 6    | 7 8 9    |
| 5'3 | 28'09 | 28'20 | 28'30 | 28'41 | 28'52 | 28'62 | 28'73 | 28'84 | 28'94 | 29'05 | 1 2 3   | 4 5 6    | 7 9 10   |
| 5'4 | 29'16 | 29'27 | 29'38 | 29'48 | 29'59 | 29'70 | 29'81 | 29'92 | 30'03 | 30'14 | 1 2 3   | 4 6 7    | 8 9 10   |

|     | 0     | 1     | 2     | 3     | 4     | 5     | 6     | 7     | 8     | 9     | 1 | 2 | 3 | 4 | 5  | 6  | 7  | 8  | 9  |
|-----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|---|---|---|---|----|----|----|----|----|
| 5·5 | 30·25 | 30·36 | 30·47 | 30·58 | 30·69 | 30·80 | 30·91 | 31·02 | 31·14 | 31·25 | 1 | 2 | 3 | 4 | 6  | 7  | 8  | 9  | 10 |
| 5·6 | 31·36 | 31·47 | 31·58 | 31·70 | 31·81 | 31·92 | 32·04 | 32·15 | 32·26 | 32·38 | 1 | 2 | 3 | 5 | 6  | 7  | 8  | 9  | 10 |
| 5·7 | 32·49 | 32·60 | 32·72 | 32·83 | 32·95 | 33·06 | 33·18 | 33·29 | 33·41 | 33·52 | 1 | 2 | 3 | 5 | 6  | 7  | 8  | 9  | 10 |
| 5·8 | 33·64 | 33·76 | 33·87 | 33·99 | 34·11 | 34·22 | 34·34 | 34·46 | 34·57 | 34·69 | 1 | 2 | 4 | 5 | 6  | 7  | 8  | 9  | 11 |
| 5·9 | 34·81 | 34·93 | 35·05 | 35·16 | 35·28 | 35·40 | 35·52 | 35·64 | 35·76 | 35·88 | 1 | 2 | 4 | 5 | 6  | 7  | 8  | 10 | 11 |
| 6·0 | 36·00 | 36·12 | 36·24 | 36·36 | 36·48 | 36·60 | 36·72 | 36·84 | 36·97 | 37·09 | 1 | 2 | 4 | 5 | 6  | 7  | 9  | 10 | 11 |
| 6·1 | 37·21 | 37·33 | 37·45 | 37·58 | 37·70 | 37·82 | 37·95 | 38·07 | 38·19 | 38·32 | 1 | 2 | 4 | 5 | 6  | 7  | 9  | 10 | 11 |
| 6·2 | 38·44 | 38·56 | 38·69 | 38·81 | 38·94 | 39·06 | 39·19 | 39·31 | 39·44 | 39·56 | 1 | 3 | 4 | 5 | 6  | 8  | 9  | 10 | 11 |
| 6·3 | 39·69 | 39·82 | 39·94 | 40·07 | 40·20 | 40·32 | 40·45 | 40·58 | 40·70 | 40·83 | 1 | 3 | 4 | 5 | 6  | 8  | 9  | 10 | 11 |
| 6·4 | 40·96 | 41·09 | 41·22 | 41·34 | 41·47 | 41·60 | 41·73 | 41·86 | 41·99 | 42·12 | 1 | 3 | 4 | 5 | 6  | 8  | 9  | 10 | 12 |
| 6·5 | 42·25 | 42·38 | 42·51 | 42·64 | 42·77 | 42·90 | 43·03 | 43·16 | 43·30 | 43·43 | 1 | 3 | 4 | 5 | 7  | 8  | 9  | 10 | 12 |
| 6·6 | 43·56 | 43·69 | 43·82 | 43·96 | 44·09 | 44·22 | 44·36 | 44·49 | 44·62 | 44·76 | 1 | 3 | 4 | 5 | 7  | 8  | 9  | 11 | 12 |
| 6·7 | 44·89 | 45·02 | 45·16 | 45·29 | 45·43 | 45·56 | 45·70 | 45·83 | 45·97 | 46·10 | 1 | 3 | 4 | 5 | 7  | 8  | 9  | 11 | 12 |
| 6·8 | 46·24 | 46·38 | 46·51 | 46·65 | 46·79 | 46·92 | 47·06 | 47·20 | 47·33 | 47·47 | 1 | 3 | 4 | 5 | 7  | 8  | 10 | 11 | 12 |
| 6·9 | 47·61 | 47·75 | 47·89 | 48·02 | 48·16 | 48·30 | 48·44 | 48·58 | 48·72 | 48·86 | 1 | 3 | 4 | 6 | 7  | 8  | 10 | 11 | 13 |
| 7·0 | 49·00 | 49·14 | 49·28 | 49·42 | 49·56 | 49·70 | 49·84 | 49·98 | 50·13 | 50·27 | 1 | 3 | 4 | 6 | 7  | 8  | 10 | 11 | 13 |
| 7·1 | 50·41 | 50·55 | 50·69 | 50·84 | 50·98 | 51·12 | 51·27 | 51·41 | 51·55 | 51·70 | 1 | 3 | 4 | 6 | 7  | 9  | 10 | 11 | 13 |
| 7·2 | 51·84 | 51·98 | 52·13 | 52·27 | 52·42 | 52·56 | 52·71 | 52·85 | 53·00 | 53·14 | 1 | 3 | 4 | 6 | 7  | 9  | 10 | 12 | 13 |
| 7·3 | 53·29 | 53·44 | 53·58 | 53·73 | 53·88 | 54·02 | 54·17 | 54·32 | 54·46 | 54·61 | 1 | 3 | 4 | 6 | 7  | 9  | 10 | 12 | 13 |
| 7·4 | 54·76 | 54·91 | 55·06 | 55·20 | 55·35 | 55·50 | 55·65 | 55·80 | 55·95 | 56·10 | 1 | 3 | 4 | 6 | 7  | 9  | 10 | 12 | 13 |
| 7·5 | 56·25 | 56·40 | 56·55 | 56·70 | 56·85 | 57·00 | 57·15 | 57·30 | 57·46 | 57·61 | 2 | 3 | 5 | 6 | 8  | 9  | 11 | 12 | 14 |
| 7·6 | 57·76 | 57·91 | 58·06 | 58·22 | 58·37 | 58·52 | 58·68 | 58·83 | 58·98 | 59·14 | 2 | 3 | 5 | 6 | 8  | 9  | 11 | 12 | 14 |
| 7·7 | 59·29 | 59·44 | 59·60 | 59·75 | 59·91 | 60·06 | 60·22 | 60·37 | 60·53 | 60·68 | 2 | 3 | 5 | 6 | 8  | 9  | 11 | 12 | 14 |
| 7·8 | 60·84 | 61·00 | 61·15 | 61·31 | 61·47 | 61·62 | 61·78 | 61·94 | 62·09 | 62·25 | 2 | 3 | 5 | 6 | 8  | 9  | 11 | 13 | 14 |
| 7·9 | 62·41 | 62·57 | 62·73 | 62·88 | 63·04 | 63·20 | 63·36 | 63·52 | 63·68 | 63·84 | 2 | 3 | 5 | 6 | 8  | 10 | 11 | 13 | 14 |
| 8·0 | 64·00 | 64·16 | 64·32 | 64·48 | 64·64 | 64·80 | 64·96 | 65·12 | 65·29 | 65·45 | 2 | 3 | 5 | 6 | 8  | 10 | 11 | 13 | 14 |
| 8·1 | 65·61 | 65·77 | 65·93 | 66·10 | 66·26 | 66·42 | 66·59 | 66·75 | 66·91 | 67·08 | 2 | 3 | 5 | 7 | 8  | 10 | 11 | 13 | 15 |
| 8·2 | 67·24 | 67·40 | 67·57 | 67·73 | 67·90 | 68·06 | 68·23 | 68·39 | 68·56 | 68·72 | 2 | 3 | 5 | 7 | 8  | 10 | 12 | 13 | 15 |
| 8·3 | 68·89 | 69·06 | 69·22 | 69·39 | 69·56 | 69·72 | 69·89 | 70·06 | 70·22 | 70·39 | 2 | 3 | 5 | 7 | 8  | 10 | 12 | 13 | 15 |
| 8·4 | 70·56 | 70·73 | 70·90 | 71·06 | 71·23 | 71·40 | 71·57 | 71·74 | 71·91 | 72·08 | 2 | 3 | 5 | 7 | 8  | 10 | 12 | 14 | 15 |
| 8·5 | 72·25 | 72·42 | 72·59 | 72·76 | 72·93 | 73·10 | 73·27 | 73·44 | 73·62 | 73·79 | 2 | 3 | 5 | 7 | 9  | 10 | 12 | 14 | 15 |
| 8·6 | 73·96 | 74·13 | 74·30 | 74·48 | 74·65 | 74·82 | 75·00 | 75·17 | 75·34 | 75·52 | 2 | 3 | 5 | 7 | 9  | 10 | 12 | 14 | 16 |
| 8·7 | 75·69 | 75·86 | 76·04 | 76·21 | 76·39 | 76·56 | 76·74 | 76·91 | 77·09 | 77·26 | 2 | 4 | 5 | 7 | 9  | 11 | 12 | 14 | 16 |
| 8·8 | 77·44 | 77·62 | 77·79 | 77·97 | 78·15 | 78·32 | 78·50 | 78·68 | 78·85 | 79·03 | 2 | 4 | 5 | 7 | 9  | 11 | 12 | 14 | 16 |
| 8·9 | 79·21 | 79·39 | 79·57 | 79·74 | 79·92 | 80·10 | 80·28 | 80·46 | 80·64 | 80·82 | 2 | 4 | 5 | 7 | 9  | 11 | 13 | 14 | 16 |
| 9·0 | 81·00 | 81·18 | 81·36 | 81·54 | 81·72 | 81·90 | 82·08 | 82·26 | 82·45 | 82·63 | 2 | 4 | 5 | 7 | 9  | 11 | 13 | 14 | 16 |
| 9·1 | 82·81 | 82·99 | 83·17 | 83·36 | 83·54 | 83·72 | 83·91 | 84·09 | 84·27 | 84·46 | 2 | 4 | 5 | 7 | 9  | 11 | 13 | 15 | 16 |
| 9·2 | 84·64 | 84·82 | 85·01 | 85·19 | 85·38 | 85·56 | 85·75 | 85·93 | 86·12 | 86·30 | 2 | 4 | 6 | 7 | 9  | 11 | 13 | 15 | 17 |
| 9·3 | 86·49 | 86·68 | 86·86 | 87·05 | 87·24 | 87·42 | 87·61 | 87·80 | 87·98 | 88·17 | 2 | 4 | 6 | 7 | 9  | 11 | 13 | 15 | 17 |
| 9·4 | 88·36 | 88·55 | 88·74 | 88·92 | 89·11 | 89·30 | 89·49 | 89·68 | 89·87 | 90·06 | 2 | 4 | 6 | 8 | 9  | 11 | 13 | 15 | 17 |
| 9·5 | 90·25 | 90·44 | 90·63 | 90·82 | 91·01 | 91·20 | 91·39 | 91·58 | 91·78 | 91·97 | 2 | 4 | 6 | 8 | 10 | 11 | 13 | 15 | 17 |
| 9·6 | 92·16 | 92·35 | 92·54 | 92·74 | 92·93 | 93·12 | 93·32 | 93·51 | 93·70 | 93·90 | 2 | 4 | 6 | 8 | 10 | 12 | 14 | 15 | 17 |
| 9·7 | 94·09 | 94·28 | 94·48 | 94·67 | 94·87 | 95·06 | 95·26 | 95·45 | 95·65 | 95·84 | 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 |
| 9·8 | 96·04 | 96·24 | 96·43 | 96·63 | 96·83 | 97·02 | 97·22 | 97·42 | 97·61 | 97·81 | 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 |
| 9·9 | 98·01 | 98·21 | 98·41 | 98·60 | 98·80 | 99·00 | 99·20 | 99·40 | 99·60 | 99·80 | 2 | 4 | 6 | 8 | 10 | 12 | 14 | 16 | 18 |



|    | 0     | 1     | 2     | 3     | 4     | 5     | 6     | 7     | 8     | 9     | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|---|---|---|---|---|---|---|---|---|
| 10 | 10'00 | 10'05 | 10'10 | 10'15 | 10'20 | 10'25 | 10'30 | 10'34 | 10'39 | 10'44 | 0 | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 |
| 11 | 10'49 | 10'54 | 10'58 | 10'63 | 10'68 | 10'72 | 10'77 | 10'82 | 10'86 | 10'91 | 0 | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 |
| 12 | 10'95 | 11'00 | 11'05 | 11'09 | 11'14 | 11'18 | 11'22 | 11'27 | 11'31 | 11'36 | 0 | 1 | 1 | 2 | 2 | 3 | 3 | 4 | 4 |
| 13 | 11'40 | 11'45 | 11'49 | 11'53 | 11'58 | 11'62 | 11'66 | 11'70 | 11'75 | 11'79 | 0 | 1 | 1 | 2 | 2 | 3 | 3 | 3 | 4 |
| 14 | 11'83 | 11'87 | 11'92 | 11'96 | 12'00 | 12'04 | 12'08 | 12'12 | 12'17 | 12'21 | 0 | 1 | 1 | 2 | 2 | 2 | 3 | 3 | 4 |
| 15 | 12'25 | 12'29 | 12'33 | 12'37 | 12'41 | 12'45 | 12'49 | 12'53 | 12'57 | 12'61 | 0 | 1 | 1 | 2 | 2 | 2 | 3 | 3 | 4 |
| 16 | 12'65 | 12'69 | 12'73 | 12'77 | 12'81 | 12'85 | 12'88 | 12'92 | 12'96 | 13'00 | 0 | 1 | 1 | 2 | 2 | 2 | 3 | 3 | 4 |
| 17 | 13'04 | 13'08 | 13'11 | 13'15 | 13'19 | 13'23 | 13'27 | 13'30 | 13'34 | 13'38 | 0 | 1 | 1 | 2 | 2 | 2 | 3 | 3 | 3 |
| 18 | 13'42 | 13'45 | 13'49 | 13'53 | 13'56 | 13'60 | 13'64 | 13'67 | 13'71 | 13'75 | 0 | 1 | 1 | 1 | 2 | 2 | 3 | 3 | 3 |
| 19 | 13'78 | 13'82 | 13'86 | 13'89 | 13'93 | 13'96 | 14'00 | 14'04 | 14'07 | 14'11 | 0 | 1 | 1 | 1 | 2 | 2 | 3 | 3 | 3 |
| 20 | 14'14 | 14'18 | 14'21 | 14'25 | 14'28 | 14'32 | 14'35 | 14'39 | 14'42 | 14'46 | 0 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 |
| 21 | 14'49 | 14'53 | 14'56 | 14'59 | 14'63 | 14'66 | 14'70 | 14'73 | 14'76 | 14'80 | 0 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 |
| 22 | 14'83 | 14'87 | 14'90 | 14'93 | 14'97 | 15'00 | 15'03 | 15'07 | 15'10 | 15'13 | 0 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 |
| 23 | 15'17 | 15'20 | 15'23 | 15'26 | 15'30 | 15'33 | 15'36 | 15'39 | 15'43 | 15'46 | 0 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 |
| 24 | 15'49 | 15'52 | 15'56 | 15'59 | 15'62 | 15'65 | 15'68 | 15'72 | 15'75 | 15'78 | 0 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 |
| 25 | 15'81 | 15'84 | 15'87 | 15'91 | 15'94 | 15'97 | 16'00 | 16'03 | 16'06 | 16'09 | 0 | 1 | 1 | 1 | 2 | 2 | 2 | 3 | 3 |
| 26 | 16'12 | 16'16 | 16'19 | 16'22 | 16'25 | 16'28 | 16'31 | 16'34 | 16'37 | 16'40 | 0 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 3 |
| 27 | 16'43 | 16'46 | 16'49 | 16'52 | 16'55 | 16'58 | 16'61 | 16'64 | 16'67 | 16'70 | 0 | 1 | 1 | 1 | 2 | 2 | 2 | 2 | 3 |
| 28 | 16'73 | 16'76 | 16'79 | 16'82 | 16'85 | 16'88 | 16'91 | 16'94 | 16'97 | 17'00 | 0 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 3 |
| 29 | 17'03 | 17'06 | 17'09 | 17'12 | 17'15 | 17'18 | 17'20 | 17'23 | 17'26 | 17'29 | 0 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 3 |
| 30 | 17'32 | 17'35 | 17'38 | 17'41 | 17'44 | 17'46 | 17'49 | 17'52 | 17'55 | 17'58 | 0 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 3 |
| 31 | 17'61 | 17'64 | 17'66 | 17'69 | 17'72 | 17'75 | 17'78 | 17'80 | 17'83 | 17'86 | 0 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 3 |
| 32 | 17'89 | 17'92 | 17'94 | 17'97 | 18'00 | 18'03 | 18'06 | 18'08 | 18'11 | 18'14 | 0 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 3 |
| 33 | 18'17 | 18'19 | 18'22 | 18'25 | 18'28 | 18'30 | 18'33 | 18'36 | 18'38 | 18'41 | 0 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 3 |
| 34 | 18'44 | 18'47 | 18'49 | 18'52 | 18'55 | 18'57 | 18'60 | 18'63 | 18'65 | 18'68 | 0 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 |
| 35 | 18'71 | 18'73 | 18'76 | 18'79 | 18'81 | 18'84 | 18'87 | 18'89 | 18'92 | 18'95 | 0 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 |
| 36 | 18'97 | 19'00 | 19'03 | 19'05 | 19'08 | 19'10 | 19'13 | 19'16 | 19'18 | 19'21 | 0 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 |
| 37 | 19'24 | 19'26 | 19'29 | 19'31 | 19'34 | 19'36 | 19'39 | 19'42 | 19'44 | 19'47 | 0 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 |
| 38 | 19'49 | 19'52 | 19'54 | 19'57 | 19'50 | 19'62 | 19'65 | 19'67 | 19'70 | 19'72 | 0 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 |
| 39 | 19'75 | 19'77 | 19'80 | 19'82 | 19'85 | 19'87 | 19'90 | 19'92 | 19'95 | 19'97 | 0 | 1 | 1 | 1 | 1 | 2 | 2 | 2 | 2 |
| 40 | 20'00 | 20'02 | 20'05 | 20'07 | 20'10 | 20'12 | 20'15 | 20'17 | 20'20 | 20'22 | 0 | 0 | 1 | 1 | 1 | 1 | 2 | 2 | 2 |
| 41 | 20'25 | 20'27 | 20'30 | 20'32 | 20'35 | 20'37 | 20'40 | 20'42 | 20'45 | 20'47 | 0 | 0 | 1 | 1 | 1 | 1 | 2 | 2 | 2 |
| 42 | 20'49 | 20'52 | 20'54 | 20'57 | 20'59 | 20'62 | 20'64 | 20'66 | 20'69 | 20'71 | 0 | 0 | 1 | 1 | 1 | 1 | 2 | 2 | 2 |
| 43 | 20'74 | 20'76 | 20'78 | 20'81 | 20'83 | 20'86 | 20'88 | 20'90 | 20'93 | 20'95 | 0 | 0 | 1 | 1 | 1 | 1 | 2 | 2 | 2 |
| 44 | 20'98 | 21'00 | 21'02 | 21'05 | 21'07 | 21'10 | 21'12 | 21'14 | 21'17 | 21'19 | 0 | 0 | 1 | 1 | 1 | 1 | 2 | 2 | 2 |
| 45 | 21'21 | 21'24 | 21'26 | 21'28 | 21'31 | 21'33 | 21'35 | 21'38 | 21'40 | 21'42 | 0 | 0 | 1 | 1 | 1 | 1 | 2 | 2 | 2 |
| 46 | 21'45 | 21'47 | 21'49 | 21'52 | 21'54 | 21'56 | 21'59 | 21'61 | 21'63 | 21'66 | 0 | 0 | 1 | 1 | 1 | 1 | 2 | 2 | 2 |
| 47 | 21'68 | 21'70 | 21'73 | 21'75 | 21'77 | 21'79 | 21'82 | 21'84 | 21'86 | 21'89 | 0 | 0 | 1 | 1 | 1 | 1 | 2 | 2 | 2 |
| 48 | 21'91 | 21'93 | 21'95 | 21'98 | 22'00 | 22'02 | 22'05 | 22'07 | 22'09 | 22'11 | 0 | 0 | 1 | 1 | 1 | 1 | 2 | 2 | 2 |
| 49 | 22'14 | 22'16 | 22'18 | 22'20 | 22'23 | 22'25 | 22'27 | 22'29 | 22'32 | 22'34 | 0 | 0 | 1 | 1 | 1 | 1 | 2 | 2 | 2 |
| 50 | 22'36 | 22'38 | 22'41 | 22'43 | 22'45 | 22'47 | 22'49 | 22'52 | 22'54 | 22'56 | 0 | 0 | 1 | 1 | 1 | 1 | 2 | 2 | 2 |
| 51 | 22'58 | 22'61 | 22'63 | 22'65 | 22'67 | 22'69 | 22'72 | 22'74 | 22'76 | 22'78 | 0 | 0 | 1 | 1 | 1 | 1 | 2 | 2 | 2 |
| 52 | 22'80 | 22'83 | 22'85 | 22'87 | 22'89 | 22'91 | 22'93 | 22'96 | 22'98 | 23'00 | 0 | 0 | 1 | 1 | 1 | 1 | 2 | 2 | 2 |
| 53 | 23'02 | 23'04 | 23'07 | 23'09 | 23'11 | 23'13 | 23'15 | 23'17 | 23'19 | 23'22 | 0 | 0 | 1 | 1 | 1 | 1 | 2 | 2 | 2 |
| 54 | 23'24 | 23'26 | 23'28 | 23'30 | 23'32 | 23'35 | 23'37 | 23'39 | 23'41 | 23'43 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 2 | 2 |



# SQUARE ROOTS FROM 100 TO 9999.

49

|    | 0     | 1     | 2     | 3     | 4     | 5     | 6     | 7     | 8     | 9     | 1 | 2 | 3 | 4 | 5 | 6 | 7 | 8 | 9 |
|----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|---|---|---|---|---|---|---|---|---|
| 55 | 23'45 | 23'47 | 23'49 | 23'52 | 23'54 | 23'56 | 23'58 | 23'60 | 23'62 | 23'64 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 2 | 2 |
| 56 | 23'66 | 23'69 | 23'71 | 23'73 | 23'75 | 23'77 | 23'79 | 23'81 | 23'83 | 23'85 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 2 | 2 |
| 57 | 23'87 | 23'90 | 23'92 | 23'94 | 23'96 | 23'98 | 24'00 | 24'02 | 24'04 | 24'06 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 2 | 2 |
| 58 | 24'08 | 24'10 | 24'12 | 24'15 | 24'17 | 24'19 | 24'21 | 24'23 | 24'25 | 24'27 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 2 | 2 |
| 59 | 24'29 | 24'31 | 24'33 | 24'35 | 24'37 | 24'39 | 24'41 | 24'43 | 24'45 | 24'47 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 2 | 2 |
| 60 | 24'49 | 24'52 | 24'54 | 24'56 | 24'58 | 24'60 | 24'62 | 24'64 | 24'66 | 24'68 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 2 | 2 |
| 61 | 24'70 | 24'72 | 24'74 | 24'76 | 24'78 | 24'80 | 24'82 | 24'84 | 24'86 | 24'88 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 2 | 2 |
| 62 | 24'90 | 24'92 | 24'94 | 24'96 | 24'98 | 25'00 | 25'02 | 25'04 | 25'06 | 25'08 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 2 | 2 |
| 63 | 25'10 | 25'12 | 25'14 | 25'16 | 25'18 | 25'20 | 25'22 | 25'24 | 25'26 | 25'28 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 2 | 2 |
| 64 | 25'30 | 25'32 | 25'34 | 25'36 | 25'38 | 25'40 | 25'42 | 25'44 | 25'46 | 25'48 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 2 | 2 |
| 65 | 25'50 | 25'51 | 25'53 | 25'55 | 25'57 | 25'59 | 25'61 | 25'63 | 25'65 | 25'67 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 2 | 2 |
| 66 | 25'69 | 25'71 | 25'73 | 25'75 | 25'77 | 25'79 | 25'81 | 25'83 | 25'85 | 25'87 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 2 | 2 |
| 67 | 25'88 | 25'90 | 25'92 | 25'94 | 25'96 | 25'98 | 26'00 | 26'02 | 26'04 | 26'06 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 2 | 2 |
| 68 | 26'08 | 26'10 | 26'12 | 26'13 | 26'15 | 26'17 | 26'19 | 26'21 | 26'23 | 26'25 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 2 | 2 |
| 69 | 26'27 | 26'29 | 26'31 | 26'32 | 26'34 | 26'36 | 26'38 | 26'40 | 26'42 | 26'44 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 2 | 2 |
| 70 | 26'46 | 26'48 | 26'50 | 26'51 | 26'53 | 26'55 | 26'57 | 26'59 | 26'61 | 26'63 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 2 | 2 |
| 71 | 26'65 | 26'66 | 26'68 | 26'70 | 26'72 | 26'74 | 26'76 | 26'78 | 26'80 | 26'81 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 2 | 2 |
| 72 | 26'83 | 26'85 | 26'87 | 26'89 | 26'91 | 26'93 | 26'94 | 26'96 | 26'98 | 27'00 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 2 | 2 |
| 73 | 27'02 | 27'04 | 27'06 | 27'07 | 27'09 | 27'11 | 27'13 | 27'15 | 27'17 | 27'18 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 2 | 2 |
| 74 | 27'20 | 27'22 | 27'24 | 27'26 | 27'28 | 27'29 | 27'31 | 27'33 | 27'35 | 27'37 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 2 | 2 |
| 75 | 27'39 | 27'40 | 27'42 | 27'44 | 27'46 | 27'48 | 27'50 | 27'51 | 27'53 | 27'55 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 2 | 2 |
| 76 | 27'57 | 27'59 | 27'60 | 27'62 | 27'64 | 27'66 | 27'68 | 27'69 | 27'71 | 27'73 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 2 | 2 |
| 77 | 27'75 | 27'77 | 27'78 | 27'80 | 27'82 | 27'84 | 27'86 | 27'87 | 27'89 | 27'91 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 2 | 2 |
| 78 | 27'93 | 27'95 | 27'96 | 27'98 | 28'00 | 28'02 | 28'04 | 28'05 | 28'07 | 28'09 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 2 | 2 |
| 79 | 28'11 | 28'12 | 28'14 | 28'16 | 28'18 | 28'20 | 28'21 | 28'23 | 28'25 | 28'27 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 2 | 2 |
| 80 | 28'28 | 28'30 | 28'32 | 28'34 | 28'35 | 28'37 | 28'39 | 28'41 | 28'43 | 28'44 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 2 | 2 |
| 81 | 28'46 | 28'48 | 28'50 | 28'51 | 28'53 | 28'55 | 28'57 | 28'58 | 28'60 | 28'62 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 2 | 2 |
| 82 | 28'64 | 28'65 | 28'67 | 28'69 | 28'71 | 28'72 | 28'74 | 28'76 | 28'77 | 28'79 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 2 | 2 |
| 83 | 28'81 | 28'83 | 28'84 | 28'86 | 28'88 | 28'90 | 28'91 | 28'93 | 28'95 | 28'97 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 2 | 2 |
| 84 | 28'98 | 29'00 | 29'02 | 29'03 | 29'05 | 29'07 | 29'09 | 29'10 | 29'12 | 29'14 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 2 | 2 |
| 85 | 29'15 | 29'17 | 29'19 | 29'21 | 29'22 | 29'24 | 29'26 | 29'27 | 29'29 | 29'31 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 2 | 2 |
| 86 | 29'33 | 29'34 | 29'36 | 29'38 | 29'39 | 29'41 | 29'43 | 29'44 | 29'46 | 29'48 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 2 | 2 |
| 87 | 29'50 | 29'51 | 29'53 | 29'55 | 29'56 | 29'58 | 29'60 | 29'61 | 29'63 | 29'65 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 2 | 2 |
| 88 | 29'66 | 29'68 | 29'70 | 29'72 | 29'73 | 29'75 | 29'77 | 29'78 | 29'80 | 29'82 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 2 | 2 |
| 89 | 29'83 | 29'85 | 29'87 | 29'88 | 29'90 | 29'92 | 29'93 | 29'95 | 29'97 | 29'98 | 0 | 0 | 1 | 1 | 1 | 1 | 1 | 2 | 2 |
| 90 | 30'00 | 30'02 | 30'03 | 30'05 | 30'07 | 30'08 | 30'10 | 30'12 | 30'13 | 30'15 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 2 | 2 |
| 91 | 30'17 | 30'18 | 30'20 | 30'22 | 30'23 | 30'25 | 30'27 | 30'28 | 30'30 | 30'32 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 2 | 2 |
| 92 | 30'33 | 30'35 | 30'36 | 30'38 | 30'40 | 30'41 | 30'43 | 30'45 | 30'46 | 30'48 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 2 | 2 |
| 93 | 30'50 | 30'51 | 30'53 | 30'55 | 30'56 | 30'58 | 30'59 | 30'61 | 30'63 | 30'64 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 2 | 2 |
| 94 | 30'66 | 30'68 | 30'69 | 30'71 | 30'72 | 30'74 | 30'76 | 30'77 | 30'79 | 30'81 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 2 | 2 |
| 95 | 30'82 | 30'84 | 30'85 | 30'87 | 30'89 | 30'90 | 30'92 | 30'94 | 30'95 | 30'97 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 2 | 2 |
| 96 | 30'98 | 31'00 | 31'02 | 31'03 | 31'05 | 31'06 | 31'08 | 31'10 | 31'11 | 31'13 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 2 | 2 |
| 97 | 31'14 | 31'16 | 31'18 | 31'19 | 31'21 | 31'22 | 31'24 | 31'26 | 31'27 | 31'29 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 2 | 2 |
| 98 | 31'30 | 31'32 | 31'34 | 31'35 | 31'37 | 31'38 | 31'40 | 31'42 | 31'43 | 31'45 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 2 | 2 |
| 99 | 31'46 | 31'48 | 31'50 | 31'51 | 31'53 | 31'54 | 31'56 | 31'58 | 31'59 | 31'61 | 0 | 0 | 0 | 1 | 1 | 1 | 1 | 2 | 2 |

|    | 0     | 1     | 2     | 3     | 4     | 5     | 6     | 7     | 8     | 9     | 123   | 456   | 789      |
|----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|----------|
| 10 | 31'62 | 31'78 | 31'94 | 32'09 | 32'25 | 32'40 | 32'56 | 32'71 | 32'86 | 33'02 | 2 3 5 | 6 8 9 | 11 12 14 |
| 11 | 33'17 | 33'32 | 33'47 | 33'62 | 33'76 | 33'91 | 34'06 | 34'21 | 34'35 | 34'50 | 1 3 4 | 6 7 9 | 10 12 13 |
| 12 | 34'64 | 34'79 | 34'93 | 35'07 | 35'21 | 35'36 | 35'50 | 35'64 | 35'78 | 35'92 | 1 3 4 | 6 7 8 | 10 11 13 |
| 13 | 36'06 | 36'19 | 36'33 | 36'47 | 36'61 | 36'74 | 36'88 | 37'01 | 37'15 | 37'28 | 1 3 4 | 5 7 8 | 10 11 12 |
| 14 | 37'42 | 37'55 | 37'68 | 37'82 | 37'95 | 38'08 | 38'21 | 38'34 | 38'47 | 38'60 | 1 3 4 | 5 7 8 | 9 11 12  |
| 15 | 38'73 | 38'86 | 38'99 | 39'12 | 39'24 | 39'37 | 39'50 | 39'62 | 39'75 | 39'87 | 1 3 4 | 5 6 8 | 9 10 11  |
| 16 | 40'00 | 40'12 | 40'25 | 40'37 | 40'50 | 40'62 | 40'74 | 40'87 | 40'99 | 41'11 | 1 2 4 | 5 6 7 | 9 10 11  |
| 17 | 41'23 | 41'35 | 41'47 | 41'59 | 41'71 | 41'83 | 41'95 | 42'07 | 42'19 | 42'31 | 1 2 4 | 5 6 7 | 8 10 11  |
| 18 | 42'43 | 42'54 | 42'66 | 42'78 | 42'90 | 43'01 | 43'13 | 43'24 | 43'36 | 43'47 | 1 2 3 | 5 6 7 | 8 9 10   |
| 19 | 43'59 | 43'70 | 43'82 | 43'93 | 44'05 | 44'16 | 44'27 | 44'38 | 44'50 | 44'61 | 1 2 3 | 5 6 7 | 8 9 10   |
| 20 | 44'72 | 44'83 | 44'94 | 45'06 | 45'17 | 45'28 | 45'39 | 45'50 | 45'61 | 45'72 | 1 2 3 | 4 6 7 | 8 9 10   |
| 21 | 45'83 | 45'93 | 46'04 | 46'15 | 46'26 | 46'37 | 46'48 | 46'58 | 46'69 | 46'80 | 1 2 3 | 4 5 6 | 8 9 10   |
| 22 | 46'90 | 47'01 | 47'12 | 47'22 | 47'33 | 47'43 | 47'54 | 47'64 | 47'75 | 47'85 | 1 2 3 | 4 5 6 | 7 8 9    |
| 23 | 47'96 | 48'06 | 48'17 | 48'27 | 48'37 | 48'48 | 48'58 | 48'68 | 48'79 | 48'89 | 1 2 3 | 4 5 6 | 7 8 9    |
| 24 | 48'99 | 49'09 | 49'19 | 49'30 | 49'40 | 49'50 | 49'60 | 49'70 | 49'80 | 49'90 | 1 2 3 | 4 5 6 | 7 8 9    |
| 25 | 50'00 | 50'10 | 50'20 | 50'30 | 50'40 | 50'50 | 50'60 | 50'70 | 50'79 | 50'89 | 1 2 3 | 4 5 6 | 7 8 9    |
| 26 | 50'99 | 51'09 | 51'19 | 51'28 | 51'38 | 51'48 | 51'58 | 51'67 | 51'77 | 51'87 | 1 2 3 | 4 5 6 | 7 8 9    |
| 27 | 51'96 | 52'06 | 52'15 | 52'25 | 52'35 | 52'44 | 52'54 | 52'63 | 52'73 | 52'82 | 1 2 3 | 4 5 6 | 7 8 9    |
| 28 | 52'92 | 53'01 | 53'10 | 53'20 | 53'29 | 53'39 | 53'48 | 53'57 | 53'67 | 53'76 | 1 2 3 | 4 5 6 | 7 7 8    |
| 29 | 53'85 | 53'94 | 54'04 | 54'13 | 54'22 | 54'31 | 54'41 | 54'50 | 54'59 | 54'68 | 1 2 3 | 4 5 5 | 6 7 8    |
| 30 | 54'77 | 54'86 | 54'95 | 55'05 | 55'14 | 55'23 | 55'32 | 55'41 | 55'50 | 55'59 | 1 2 3 | 4 4 5 | 6 7 8    |
| 31 | 55'68 | 55'77 | 55'86 | 55'95 | 56'04 | 56'12 | 56'21 | 56'30 | 56'39 | 56'48 | 1 2 3 | 3 4 5 | 6 7 8    |
| 32 | 56'57 | 56'66 | 56'75 | 56'83 | 56'92 | 57'01 | 57'10 | 57'18 | 57'27 | 57'36 | 1 2 3 | 3 4 5 | 6 7 8    |
| 33 | 57'45 | 57'53 | 57'62 | 57'71 | 57'79 | 57'88 | 57'97 | 58'05 | 58'14 | 58'22 | 1 2 3 | 3 4 5 | 6 7 8    |
| 34 | 58'31 | 58'40 | 58'48 | 58'57 | 58'65 | 58'74 | 58'82 | 58'91 | 58'99 | 59'08 | 1 2 3 | 3 4 5 | 6 7 8    |
| 35 | 59'16 | 59'25 | 59'33 | 59'41 | 59'50 | 59'58 | 59'67 | 59'75 | 59'83 | 59'92 | 1 2 3 | 3 4 5 | 6 7 8    |
| 36 | 60'00 | 60'08 | 60'17 | 60'25 | 60'33 | 60'42 | 60'50 | 60'58 | 60'66 | 60'75 | 1 2 2 | 3 4 5 | 6 7 7    |
| 37 | 60'83 | 60'91 | 60'99 | 61'07 | 61'16 | 61'24 | 61'32 | 61'40 | 61'48 | 61'56 | 1 2 2 | 3 4 5 | 6 7 7    |
| 38 | 61'64 | 61'73 | 61'81 | 61'89 | 61'97 | 62'05 | 62'13 | 62'21 | 62'29 | 62'37 | 1 2 2 | 3 4 5 | 6 6 7    |
| 39 | 62'45 | 62'53 | 62'61 | 62'69 | 62'77 | 62'85 | 62'93 | 63'01 | 63'09 | 63'17 | 1 2 2 | 3 4 5 | 6 6 7    |
| 40 | 63'25 | 63'32 | 63'40 | 63'48 | 63'56 | 63'64 | 63'72 | 63'80 | 63'87 | 63'95 | 1 2 2 | 3 4 5 | 6 6 7    |
| 41 | 64'03 | 64'11 | 64'19 | 64'27 | 64'34 | 64'42 | 64'50 | 64'58 | 64'65 | 64'73 | 1 2 2 | 3 4 5 | 5 6 7    |
| 42 | 64'81 | 64'88 | 64'96 | 65'04 | 65'12 | 65'19 | 65'27 | 65'35 | 65'42 | 65'50 | 1 2 2 | 3 4 5 | 5 6 7    |
| 43 | 65'57 | 65'65 | 65'73 | 65'80 | 65'88 | 65'95 | 66'03 | 66'11 | 66'18 | 66'26 | 1 2 2 | 3 4 5 | 5 6 7    |
| 44 | 66'33 | 66'41 | 66'48 | 66'56 | 66'63 | 66'71 | 66'78 | 66'86 | 66'93 | 67'01 | 1 2 2 | 3 4 5 | 5 6 7    |
| 45 | 67'08 | 67'16 | 67'23 | 67'31 | 67'38 | 67'45 | 67'53 | 67'60 | 67'68 | 67'75 | 1 1 2 | 3 4 4 | 5 6 7    |
| 46 | 67'82 | 67'90 | 67'97 | 68'04 | 68'12 | 68'19 | 68'26 | 68'34 | 68'41 | 68'48 | 1 1 2 | 3 4 4 | 5 6 7    |
| 47 | 68'56 | 68'63 | 68'70 | 68'77 | 68'85 | 68'92 | 68'99 | 69'07 | 69'14 | 69'21 | 1 1 2 | 3 4 4 | 5 6 7    |
| 48 | 69'28 | 69'35 | 69'43 | 69'50 | 69'57 | 69'64 | 69'71 | 69'79 | 69'86 | 69'93 | 1 1 2 | 3 4 4 | 5 6 6    |
| 49 | 70'00 | 70'07 | 70'14 | 70'21 | 70'29 | 70'36 | 70'43 | 70'50 | 70'57 | 70'64 | 1 1 2 | 3 4 4 | 5 6 6    |
| 50 | 70'71 | 70'78 | 70'85 | 70'92 | 70'99 | 71'06 | 71'13 | 71'20 | 71'27 | 71'34 | 1 1 2 | 3 4 4 | 5 6 6    |
| 51 | 71'41 | 71'48 | 71'55 | 71'62 | 71'69 | 71'76 | 71'83 | 71'90 | 71'97 | 72'04 | 1 1 2 | 3 4 4 | 5 6 6    |
| 52 | 72'11 | 72'18 | 72'25 | 72'32 | 72'39 | 72'46 | 72'53 | 72'59 | 72'66 | 72'73 | 1 1 2 | 3 3 4 | 5 6 6    |
| 53 | 72'80 | 72'87 | 72'94 | 73'01 | 73'08 | 73'14 | 73'21 | 73'28 | 73'35 | 73'42 | 1 1 2 | 3 3 4 | 5 5 6    |
| 54 | 73'48 | 73'55 | 73'62 | 73'69 | 73'76 | 73'82 | 73'89 | 73'96 | 74'03 | 74'09 | 1 1 2 | 3 3 4 | 5 5 6    |

|    | 0     | 1     | 2     | 3     | 4     | 5     | 6     | 7     | 8     | 9     | 123   | 456   | 789   |
|----|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|-------|
| 55 | 74'16 | 74'23 | 74'30 | 74'36 | 74'43 | 74'50 | 74'57 | 74'63 | 74'70 | 74'77 | 1 1 2 | 3 3 4 | 5 5 6 |
| 56 | 74'83 | 74'90 | 74'97 | 75'03 | 75'10 | 75'17 | 75'23 | 75'30 | 75'37 | 75'43 | 1 1 2 | 3 3 4 | 5 5 6 |
| 57 | 75'50 | 75'56 | 75'63 | 75'70 | 75'76 | 75'83 | 75'89 | 75'96 | 76'03 | 76'09 | 1 1 2 | 3 3 4 | 5 5 6 |
| 58 | 76'16 | 76'22 | 76'29 | 76'35 | 76'42 | 76'49 | 76'55 | 76'62 | 76'68 | 76'75 | 1 1 2 | 3 3 4 | 5 5 6 |
| 59 | 76'81 | 76'88 | 76'94 | 77'01 | 77'07 | 77'14 | 77'20 | 77'27 | 77'33 | 77'40 | 1 1 2 | 3 3 4 | 4 5 6 |
| 60 | 77'46 | 77'52 | 77'59 | 77'65 | 77'72 | 77'78 | 77'85 | 77'91 | 77'97 | 78'04 | 1 1 2 | 3 3 4 | 4 5 6 |
| 61 | 78'10 | 78'17 | 78'23 | 78'29 | 78'36 | 78'42 | 78'49 | 78'55 | 78'61 | 78'68 | 1 1 2 | 3 3 4 | 4 5 6 |
| 62 | 78'74 | 78'80 | 78'87 | 78'93 | 78'99 | 79'06 | 79'12 | 79'18 | 79'25 | 79'31 | 1 1 2 | 3 3 4 | 4 5 6 |
| 63 | 79'37 | 79'44 | 79'50 | 79'56 | 79'62 | 79'69 | 79'75 | 79'81 | 79'87 | 79'94 | 1 1 2 | 3 3 4 | 4 5 6 |
| 64 | 80'00 | 80'06 | 80'12 | 80'19 | 80'25 | 80'31 | 80'37 | 80'44 | 80'50 | 80'56 | 1 1 2 | 2 3 4 | 4 5 6 |
| 65 | 80'62 | 80'68 | 80'75 | 80'81 | 80'87 | 80'93 | 80'99 | 81'06 | 81'12 | 81'18 | 1 1 2 | 2 3 4 | 4 5 5 |
| 66 | 81'24 | 81'30 | 81'36 | 81'42 | 81'49 | 81'55 | 81'61 | 81'67 | 81'73 | 81'79 | 1 1 2 | 2 3 4 | 4 5 5 |
| 67 | 81'85 | 81'91 | 81'98 | 82'04 | 82'10 | 82'16 | 82'22 | 82'28 | 82'34 | 82'40 | 1 1 2 | 2 3 4 | 4 5 5 |
| 68 | 82'46 | 82'52 | 82'58 | 82'64 | 82'70 | 82'76 | 82'83 | 82'89 | 82'95 | 83'01 | 1 1 2 | 2 3 4 | 4 5 5 |
| 69 | 83'07 | 83'13 | 83'19 | 83'25 | 83'31 | 83'37 | 83'43 | 83'49 | 83'55 | 83'61 | 1 1 2 | 2 3 4 | 4 5 5 |
| 70 | 83'67 | 83'73 | 83'79 | 83'85 | 83'90 | 83'96 | 84'02 | 84'08 | 84'14 | 84'20 | 1 1 2 | 2 3 4 | 4 5 5 |
| 71 | 84'26 | 84'32 | 84'38 | 84'44 | 84'50 | 84'56 | 84'62 | 84'68 | 84'73 | 84'79 | 1 1 2 | 2 3 4 | 4 5 5 |
| 72 | 84'85 | 84'91 | 84'97 | 85'03 | 85'09 | 85'15 | 85'21 | 85'26 | 85'32 | 85'38 | 1 1 2 | 2 3 3 | 4 5 5 |
| 73 | 85'44 | 85'50 | 85'56 | 85'62 | 85'67 | 85'73 | 85'79 | 85'85 | 85'91 | 85'97 | 1 1 2 | 2 3 3 | 4 5 5 |
| 74 | 86'02 | 86'08 | 86'14 | 86'20 | 86'26 | 86'31 | 86'37 | 86'43 | 86'49 | 86'54 | 1 1 2 | 2 3 3 | 4 5 5 |
| 75 | 86'60 | 86'66 | 86'72 | 86'78 | 86'83 | 86'89 | 86'95 | 87'01 | 87'06 | 87'12 | 1 1 2 | 2 3 3 | 4 5 5 |
| 76 | 87'18 | 87'24 | 87'29 | 87'35 | 87'41 | 87'46 | 87'52 | 87'58 | 87'64 | 87'69 | 1 1 2 | 2 3 3 | 4 5 5 |
| 77 | 87'75 | 87'81 | 87'86 | 87'92 | 87'98 | 88'03 | 88'09 | 88'15 | 88'20 | 88'26 | 1 1 2 | 2 3 3 | 4 4 5 |
| 78 | 88'32 | 88'37 | 88'43 | 88'49 | 88'54 | 88'60 | 88'66 | 88'71 | 88'77 | 88'83 | 1 1 2 | 2 3 3 | 4 4 5 |
| 79 | 88'88 | 88'94 | 88'99 | 89'05 | 89'11 | 89'16 | 89'22 | 89'27 | 89'33 | 89'39 | 1 1 2 | 2 3 3 | 4 4 5 |
| 80 | 89'44 | 89'50 | 89'55 | 89'61 | 89'67 | 89'72 | 89'78 | 89'83 | 89'89 | 89'94 | 1 1 2 | 2 3 3 | 4 4 5 |
| 81 | 90'00 | 90'06 | 90'11 | 90'17 | 90'22 | 90'28 | 90'33 | 90'39 | 90'44 | 90'50 | 1 1 2 | 2 3 3 | 4 4 5 |
| 82 | 90'55 | 90'61 | 90'66 | 90'72 | 90'77 | 90'83 | 90'88 | 90'94 | 90'99 | 91'05 | 1 1 2 | 2 3 3 | 4 4 5 |
| 83 | 91'10 | 91'16 | 91'21 | 91'27 | 91'32 | 91'38 | 91'43 | 91'49 | 91'54 | 91'60 | 1 1 2 | 2 3 3 | 4 4 5 |
| 84 | 91'65 | 91'71 | 91'76 | 91'82 | 91'87 | 91'92 | 91'98 | 92'03 | 92'09 | 92'14 | 1 1 2 | 2 3 3 | 4 4 5 |
| 85 | 92'20 | 92'25 | 92'30 | 92'36 | 92'41 | 92'47 | 92'52 | 92'57 | 92'63 | 92'68 | 1 1 2 | 2 3 3 | 4 4 5 |
| 86 | 92'74 | 92'79 | 92'84 | 92'90 | 92'95 | 93'01 | 93'06 | 93'11 | 93'17 | 93'22 | 1 1 2 | 2 3 3 | 4 4 5 |
| 87 | 93'27 | 93'33 | 93'38 | 93'43 | 93'49 | 93'54 | 93'59 | 93'65 | 93'70 | 93'75 | 1 1 2 | 2 3 3 | 4 4 5 |
| 88 | 93'81 | 93'86 | 93'91 | 93'97 | 94'02 | 94'07 | 94'13 | 94'18 | 94'23 | 94'29 | 1 1 2 | 2 3 3 | 4 4 5 |
| 89 | 94'34 | 94'39 | 94'45 | 94'50 | 94'55 | 94'60 | 94'66 | 94'71 | 94'76 | 94'82 | 1 1 2 | 2 3 3 | 4 4 5 |
| 90 | 94'87 | 94'92 | 94'97 | 95'03 | 95'08 | 95'13 | 95'18 | 95'24 | 95'29 | 95'34 | 1 1 2 | 2 3 3 | 4 4 5 |
| 91 | 95'39 | 95'45 | 95'50 | 95'55 | 95'60 | 95'66 | 95'71 | 95'76 | 95'81 | 95'86 | 1 1 2 | 2 3 3 | 4 4 5 |
| 92 | 95'92 | 95'97 | 96'02 | 96'07 | 96'12 | 96'18 | 96'23 | 96'28 | 96'33 | 96'38 | 1 1 2 | 2 3 3 | 4 4 5 |
| 93 | 96'44 | 96'49 | 96'54 | 96'59 | 96'64 | 96'70 | 96'75 | 96'80 | 96'85 | 96'90 | 1 1 2 | 2 3 3 | 4 4 5 |
| 94 | 96'95 | 97'01 | 97'06 | 97'11 | 97'16 | 97'21 | 97'26 | 97'31 | 97'37 | 97'42 | 1 1 2 | 2 3 3 | 4 4 5 |
| 95 | 97'47 | 97'52 | 97'57 | 97'62 | 97'67 | 97'72 | 97'78 | 97'83 | 97'88 | 97'93 | 1 1 2 | 2 3 3 | 4 4 5 |
| 96 | 97'98 | 98'03 | 98'08 | 98'13 | 98'18 | 98'23 | 98'29 | 98'34 | 98'39 | 98'44 | 1 1 2 | 2 3 3 | 4 4 5 |
| 97 | 98'49 | 98'54 | 98'59 | 98'64 | 98'69 | 98'74 | 98'79 | 98'84 | 98'89 | 98'94 | 1 1 2 | 2 3 3 | 4 4 5 |
| 98 | 98'99 | 99'05 | 99'10 | 99'15 | 99'20 | 99'25 | 99'30 | 99'35 | 99'40 | 99'45 | 0 1 1 | 2 2 3 | 3 4 4 |
| 99 | 99'50 | 99'55 | 99'60 | 99'65 | 99'70 | 99'75 | 99'80 | 99'85 | 99'90 | 99'95 | 0 1 1 | 2 2 3 | 3 4 4 |



|    | 0         | 1    | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 1 2 3   | 4 5 6    | 7 8 9    |
|----|-----------|------|------|------|------|------|------|------|------|------|---------|----------|----------|
| 10 | 0'0010000 | 9901 | 9804 | 9709 | 9615 | 9524 | 9434 | 9346 | 9259 | 9174 | 9 18 27 | 36 45 55 | 64 73 82 |
| 11 | 0'0009091 | 9009 | 8929 | 8850 | 8772 | 8696 | 8621 | 8547 | 8475 | 8403 | 8 15 23 | 30 38 45 | 53 61 68 |
| 12 | 0'0008333 | 8264 | 8197 | 8130 | 8065 | 8000 | 7937 | 7874 | 7813 | 7752 | 6 13 19 | 26 32 38 | 45 51 58 |
| 13 | 0'0007692 | 7634 | 7576 | 7519 | 7463 | 7407 | 7353 | 7299 | 7246 | 7194 | 5 11 16 | 22 27 33 | 38 44 49 |
| 14 | 0'0007143 | 7092 | 7042 | 6993 | 6944 | 6897 | 6849 | 6803 | 6757 | 6711 | 5 10 14 | 19 24 29 | 33 38 43 |
| 15 | 0'0006667 | 6623 | 6579 | 6536 | 6494 | 6452 | 6410 | 6369 | 6329 | 6289 | 4 8 13  | 17 21 25 | 29 33 38 |
| 16 | 0'0006250 | 6211 | 6173 | 6135 | 6098 | 6061 | 6024 | 5988 | 5952 | 5917 | 4 7 11  | 15 18 22 | 26 29 33 |
| 17 | 0'0005882 | 5848 | 5814 | 5780 | 5747 | 5714 | 5682 | 5650 | 5618 | 5587 | 3 6 10  | 13 16 20 | 23 26 29 |
| 18 | 0'0005556 | 5525 | 5495 | 5464 | 5435 | 5405 | 5376 | 5348 | 5319 | 5291 | 3 6 9   | 12 15 17 | 20 23 26 |
| 19 | 0'0005263 | 5236 | 5208 | 5181 | 5155 | 5128 | 5102 | 5076 | 5051 | 5025 | 3 5 8   | 11 13 16 | 18 21 24 |
| 20 | 0'0005000 | 4975 | 4950 | 4926 | 4902 | 4878 | 4854 | 4831 | 4808 | 4785 | 2 5 7   | 10 12 14 | 17 19 21 |
| 21 | 0'0004762 | 4739 | 4717 | 4695 | 4673 | 4651 | 4630 | 4608 | 4587 | 4566 | 2 4 7   | 9 11 13  | 15 17 20 |
| 22 | 0'0004545 | 4525 | 4505 | 4484 | 4464 | 4444 | 4425 | 4405 | 4386 | 4367 | 2 4 6   | 8 10 12  | 14 16 18 |
| 23 | 0'0004348 | 4329 | 4310 | 4292 | 4274 | 4255 | 4237 | 4219 | 4202 | 4184 | 2 4 5   | 7 9 11   | 13 14 16 |
| 24 | 0'0004167 | 4149 | 4132 | 4115 | 4098 | 4082 | 4065 | 4049 | 4032 | 4016 | 2 3 5   | 7 8 10   | 12 13 15 |
| 25 | 0'0004000 | 3984 | 3968 | 3953 | 3937 | 3922 | 3906 | 3891 | 3876 | 3861 | 2 3 5   | 6 8 9    | 11 12 14 |
| 26 | 0'0003846 | 3831 | 3817 | 3802 | 3788 | 3774 | 3759 | 3745 | 3731 | 3717 | 1 3 4   | 6 7 8    | 10 11 13 |
| 27 | 0'0003704 | 3690 | 3676 | 3663 | 3650 | 3636 | 3623 | 3610 | 3597 | 3584 | 1 3 4   | 5 7 8    | 9 11 12  |
| 28 | 0'0003571 | 3559 | 3546 | 3534 | 3521 | 3509 | 3497 | 3484 | 3472 | 3460 | 1 2 4   | 5 6 7    | 10 11 11 |
| 29 | 0'0003448 | 3436 | 3425 | 3413 | 3401 | 3390 | 3378 | 3367 | 3356 | 3344 | 1 2 3   | 5 6 7    | 8 9 10   |
| 30 | 0'0003333 | 3322 | 3311 | 3300 | 3289 | 3279 | 3268 | 3257 | 3247 | 3236 | 1 2 3   | 4 5 6    | 7 9 10   |
| 31 | 0'0003226 | 3215 | 3205 | 3195 | 3185 | 3175 | 3165 | 3155 | 3145 | 3135 | 1 2 3   | 4 5 6    | 7 8 9    |
| 32 | 0'0003125 | 3115 | 3106 | 3096 | 3086 | 3077 | 3067 | 3058 | 3049 | 3040 | 1 2 3   | 4 5 6    | 7 8 9    |
| 33 | 0'0003030 | 3021 | 3012 | 3003 | 2994 | 2985 | 2976 | 2967 | 2959 | 2950 | 1 2 3   | 4 4 5    | 6 7 8    |
| 34 | 0'0002941 | 2933 | 2924 | 2915 | 2907 | 2899 | 2890 | 2882 | 2874 | 2865 | 1 2 3   | 3 4 5    | 6 7 8    |
| 35 | 0'0002857 | 2849 | 2841 | 2833 | 2825 | 2817 | 2809 | 2801 | 2793 | 2786 | 1 2 2   | 3 4 5    | 6 6 7    |
| 36 | 0'0002778 | 2770 | 2762 | 2755 | 2747 | 2740 | 2732 | 2725 | 2717 | 2710 | 1 2 2   | 3 4 5    | 5 6 7    |
| 37 | 0'0002703 | 2695 | 2688 | 2681 | 2674 | 2667 | 2660 | 2653 | 2646 | 2639 | 1 1 2   | 3 4 4    | 5 6 6    |
| 38 | 0'0002632 | 2625 | 2618 | 2611 | 2604 | 2597 | 2591 | 2584 | 2577 | 2571 | 1 1 2   | 3 3 4    | 5 5 6    |
| 39 | 0'0002564 | 2558 | 2551 | 2545 | 2538 | 2532 | 2525 | 2519 | 2513 | 2506 | 1 1 2   | 3 3 4    | 4 5 6    |
| 40 | 0'0002500 | 2494 | 2488 | 2481 | 2475 | 2469 | 2463 | 2457 | 2451 | 2445 | 1 1 2   | 2 3 4    | 4 5 5    |
| 41 | 0'0002439 | 2433 | 2427 | 2421 | 2415 | 2410 | 2404 | 2398 | 2392 | 2387 | 1 1 2   | 2 3 3    | 4 5 5    |
| 42 | 0'0002381 | 2375 | 2370 | 2364 | 2358 | 2353 | 2347 | 2342 | 2336 | 2331 | 1 1 2   | 2 3 3    | 4 4 5    |
| 43 | 0'0002326 | 2320 | 2315 | 2309 | 2304 | 2299 | 2294 | 2288 | 2283 | 2278 | 1 1 2   | 2 3 3    | 4 4 5    |
| 44 | 0'0002273 | 2268 | 2262 | 2257 | 2252 | 2247 | 2242 | 2237 | 2232 | 2227 | 1 1 2   | 2 3 3    | 4 4 5    |
| 45 | 0'0002222 | 2217 | 2212 | 2208 | 2203 | 2198 | 2193 | 2188 | 2183 | 2179 | 0 1 1   | 2 2 3    | 3 4 4    |
| 46 | 0'0002174 | 2169 | 2165 | 2160 | 2155 | 2151 | 2146 | 2141 | 2137 | 2132 | 0 1 1   | 2 2 3    | 3 4 4    |
| 47 | 0'0002128 | 2123 | 2119 | 2114 | 2110 | 2105 | 2101 | 2096 | 2092 | 2088 | 0 1 1   | 2 2 3    | 3 4 4    |
| 48 | 0'0002083 | 2079 | 2075 | 2070 | 2066 | 2062 | 2058 | 2053 | 2049 | 2045 | 0 1 1   | 2 2 3    | 3 3 4    |
| 49 | 0'0002041 | 2037 | 2033 | 2028 | 2024 | 2020 | 2016 | 2012 | 2008 | 2004 | 0 1 1   | 2 2 2    | 3 3 4    |
| 50 | 0'0002000 | 1996 | 1992 | 1988 | 1984 | 1980 | 1976 | 1972 | 1969 | 1965 | 0 1 1   | 2 2 2    | 3 3 4    |
| 51 | 0'0001961 | 1957 | 1953 | 1949 | 1946 | 1942 | 1938 | 1934 | 1931 | 1927 | 0 1 1   | 2 2 2    | 3 3 3    |
| 52 | 0'0001923 | 1919 | 1916 | 1912 | 1908 | 1905 | 1901 | 1898 | 1894 | 1890 | 0 1 1   | 1 2 2    | 3 3 3    |
| 53 | 0'0001887 | 1883 | 1880 | 1876 | 1873 | 1869 | 1866 | 1862 | 1859 | 1855 | 0 1 1   | 1 2 2    | 2 3 3    |
| 54 | 0'0001852 | 1848 | 1845 | 1842 | 1838 | 1835 | 1832 | 1828 | 1825 | 1821 | 0 1 1   | 1 2 2    | 2 3 3    |

*N.B.*—Three zeros follow the decimal point in the reciprocal of any four figure whole number except the number 1000.

*NOTE.*—Numbers in difference columns to be subtracted, not added.—*See Rules.*



|    | 0         | 1    | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 123   | 456   | 789   |
|----|-----------|------|------|------|------|------|------|------|------|------|-------|-------|-------|
| 55 | 0'0001818 | 1815 | 1812 | 1808 | 1805 | 1802 | 1799 | 1795 | 1792 | 1789 | 0 1 1 | 1 2 2 | 2 3 3 |
| 56 | 0'0001786 | 1783 | 1779 | 1776 | 1773 | 1770 | 1767 | 1764 | 1761 | 1757 | 0 1 1 | 1 2 2 | 2 3 3 |
| 57 | 0'0001754 | 1751 | 1748 | 1745 | 1742 | 1739 | 1736 | 1733 | 1730 | 1727 | 0 1 1 | 1 2 2 | 2 2 3 |
| 58 | 0'0001724 | 1721 | 1718 | 1715 | 1712 | 1709 | 1706 | 1704 | 1701 | 1698 | 0 1 1 | 1 1 2 | 2 2 3 |
| 59 | 0'0001695 | 1692 | 1689 | 1686 | 1684 | 1681 | 1678 | 1675 | 1672 | 1669 | 0 1 1 | 1 1 2 | 2 2 3 |
| 60 | 0'0001667 | 1664 | 1661 | 1658 | 1656 | 1653 | 1650 | 1647 | 1645 | 1642 | 0 1 1 | 1 1 2 | 2 2 3 |
| 61 | 0'0001639 | 1637 | 1634 | 1631 | 1629 | 1626 | 1623 | 1621 | 1618 | 1616 | 0 1 1 | 1 1 2 | 2 2 2 |
| 62 | 0'0001613 | 1610 | 1608 | 1605 | 1603 | 1600 | 1597 | 1595 | 1592 | 1590 | 0 1 1 | 1 1 2 | 2 2 2 |
| 63 | 0'0001587 | 1585 | 1582 | 1580 | 1577 | 1575 | 1572 | 1570 | 1567 | 1565 | 0 0 1 | 1 1 1 | 2 2 2 |
| 64 | 0'0001563 | 1560 | 1558 | 1555 | 1553 | 1550 | 1548 | 1546 | 1543 | 1541 | 0 0 1 | 1 1 1 | 2 2 2 |
| 65 | 0'0001538 | 1536 | 1534 | 1531 | 1529 | 1527 | 1524 | 1522 | 1520 | 1517 | 0 0 1 | 1 1 1 | 2 2 2 |
| 66 | 0'0001515 | 1513 | 1511 | 1508 | 1506 | 1504 | 1502 | 1499 | 1497 | 1495 | 0 0 1 | 1 1 1 | 2 2 2 |
| 67 | 0'0001493 | 1490 | 1488 | 1486 | 1484 | 1481 | 1479 | 1477 | 1475 | 1473 | 0 0 1 | 1 1 1 | 2 2 2 |
| 68 | 0'0001471 | 1468 | 1466 | 1464 | 1462 | 1460 | 1458 | 1456 | 1453 | 1451 | 0 0 1 | 1 1 1 | 2 2 2 |
| 69 | 0'0001449 | 1447 | 1445 | 1443 | 1441 | 1439 | 1437 | 1435 | 1433 | 1431 | 0 0 1 | 1 1 1 | 2 2 2 |
| 70 | 0'0001429 | 1427 | 1425 | 1422 | 1420 | 1418 | 1416 | 1414 | 1412 | 1410 | 0 0 1 | 1 1 1 | 1 2 2 |
| 71 | 0'0001408 | 1406 | 1404 | 1403 | 1401 | 1399 | 1397 | 1395 | 1393 | 1391 | 0 0 1 | 1 1 1 | 1 2 2 |
| 72 | 0'0001389 | 1387 | 1385 | 1383 | 1381 | 1379 | 1377 | 1376 | 1374 | 1372 | 0 0 1 | 1 1 1 | 1 2 2 |
| 73 | 0'0001370 | 1368 | 1366 | 1364 | 1362 | 1361 | 1359 | 1357 | 1355 | 1353 | 0 0 1 | 1 1 1 | 1 2 2 |
| 74 | 0'0001351 | 1350 | 1348 | 1346 | 1344 | 1342 | 1340 | 1339 | 1337 | 1335 | 0 0 1 | 1 1 1 | 1 1 2 |
| 75 | 0'0001333 | 1332 | 1330 | 1328 | 1326 | 1325 | 1323 | 1321 | 1319 | 1318 | 0 0 1 | 1 1 1 | 1 1 2 |
| 76 | 0'0001316 | 1314 | 1312 | 1311 | 1309 | 1307 | 1305 | 1304 | 1302 | 1300 | 0 0 1 | 1 1 1 | 1 1 2 |
| 77 | 0'0001299 | 1297 | 1295 | 1294 | 1292 | 1290 | 1289 | 1287 | 1285 | 1284 | 0 0 0 | 1 1 1 | 1 1 1 |
| 78 | 0'0001282 | 1280 | 1279 | 1277 | 1276 | 1274 | 1272 | 1271 | 1269 | 1267 | 0 0 0 | 1 1 1 | 1 1 1 |
| 79 | 0'0001266 | 1264 | 1263 | 1261 | 1259 | 1258 | 1256 | 1255 | 1253 | 1252 | 0 0 0 | 1 1 1 | 1 1 1 |
| 80 | 0'0001250 | 1248 | 1247 | 1245 | 1244 | 1242 | 1241 | 1239 | 1238 | 1236 | 0 0 0 | 1 1 1 | 1 1 1 |
| 81 | 0'0001235 | 1233 | 1232 | 1230 | 1229 | 1227 | 1225 | 1224 | 1222 | 1221 | 0 0 0 | 1 1 1 | 1 1 1 |
| 82 | 0'0001220 | 1218 | 1217 | 1215 | 1214 | 1212 | 1211 | 1209 | 1208 | 1206 | 0 0 0 | 1 1 1 | 1 1 1 |
| 83 | 0'0001205 | 1203 | 1202 | 1200 | 1199 | 1198 | 1196 | 1195 | 1193 | 1192 | 0 0 0 | 1 1 1 | 1 1 1 |
| 84 | 0'0001190 | 1189 | 1188 | 1186 | 1185 | 1183 | 1182 | 1181 | 1179 | 1178 | 0 0 0 | 1 1 1 | 1 1 1 |
| 85 | 0'0001176 | 1175 | 1174 | 1172 | 1171 | 1170 | 1168 | 1167 | 1166 | 1164 | 0 0 0 | 1 1 1 | 1 1 1 |
| 86 | 0'0001163 | 1161 | 1160 | 1159 | 1157 | 1156 | 1155 | 1153 | 1152 | 1151 | 0 0 0 | 1 1 1 | 1 1 1 |
| 87 | 0'0001149 | 1148 | 1147 | 1145 | 1144 | 1143 | 1142 | 1140 | 1139 | 1138 | 0 0 0 | 1 1 1 | 1 1 1 |
| 88 | 0'0001136 | 1135 | 1134 | 1133 | 1131 | 1130 | 1129 | 1127 | 1126 | 1125 | 0 0 0 | 1 1 1 | 1 1 1 |
| 89 | 0'0001124 | 1122 | 1121 | 1120 | 1119 | 1117 | 1116 | 1115 | 1114 | 1112 | 0 0 0 | 1 1 1 | 1 1 1 |
| 90 | 0'0001111 | 1110 | 1109 | 1107 | 1106 | 1105 | 1104 | 1103 | 1101 | 1100 | 0 0 0 | 1 1 1 | 1 1 1 |
| 91 | 0'0001099 | 1098 | 1096 | 1095 | 1094 | 1093 | 1092 | 1091 | 1089 | 1088 | 0 0 0 | 0 1 1 | 1 1 1 |
| 92 | 0'0001087 | 1086 | 1085 | 1083 | 1082 | 1081 | 1080 | 1079 | 1078 | 1076 | 0 0 0 | 0 1 1 | 1 1 1 |
| 93 | 0'0001075 | 1074 | 1073 | 1072 | 1071 | 1070 | 1068 | 1067 | 1066 | 1065 | 0 0 0 | 0 1 1 | 1 1 1 |
| 94 | 0'0001064 | 1063 | 1062 | 1060 | 1059 | 1058 | 1057 | 1056 | 1055 | 1054 | 0 0 0 | 0 1 1 | 1 1 1 |
| 95 | 0'0001053 | 1052 | 1050 | 1049 | 1048 | 1047 | 1046 | 1045 | 1044 | 1043 | 0 0 0 | 0 1 1 | 1 1 1 |
| 96 | 0'0001042 | 1041 | 1040 | 1038 | 1037 | 1036 | 1035 | 1034 | 1033 | 1032 | 0 0 0 | 0 1 1 | 1 1 1 |
| 97 | 0'0001031 | 1030 | 1029 | 1028 | 1027 | 1026 | 1025 | 1024 | 1022 | 1021 | 0 0 0 | 0 1 1 | 1 1 1 |
| 98 | 0'0001020 | 1019 | 1018 | 1017 | 1016 | 1015 | 1014 | 1013 | 1012 | 1011 | 0 0 0 | 0 1 1 | 1 1 1 |
| 99 | 0'0001010 | 1009 | 1008 | 1007 | 1006 | 1005 | 1004 | 1003 | 1002 | 1001 | 0 0 0 | 0 0 1 | 1 1 1 |

N.B.—Three zeros follow the decimal point in the reciprocal of any four figure whole number except the number 1000.

NOTE.—Numbers in difference columns to be subtracted, not added.—See Rules.

|     | 0      | 1      | 2      | 3      | 4      | 5      | 6      | 7      | 8      | 9      | 1  | 2  | 3  | 4  | 5  | 6  | 7  | 8  | 9  |
|-----|--------|--------|--------|--------|--------|--------|--------|--------|--------|--------|----|----|----|----|----|----|----|----|----|
| 1.0 | 0.0000 | 0.100  | 0.198  | 0.296  | 0.392  | 0.488  | 0.583  | 0.677  | 0.770  | 0.862  | 10 | 19 | 29 | 38 | 48 | 57 | 67 | 76 | 86 |
| 1.1 | 0.0953 | 1.044  | 1.133  | 1.222  | 1.310  | 1.398  | 1.484  | 1.570  | 1.655  | 1.740  | 9  | 17 | 26 | 35 | 44 | 52 | 61 | 70 | 78 |
| 1.2 | 0.1823 | 1.906  | 1.989  | 2.070  | 2.151  | 2.231  | 2.311  | 2.390  | 2.469  | 2.546  | 8  | 16 | 24 | 32 | 40 | 48 | 56 | 64 | 72 |
| 1.3 | 0.2624 | 2.700  | 2.776  | 2.852  | 2.927  | 3.001  | 3.075  | 3.148  | 3.221  | 3.293  | 7  | 15 | 22 | 30 | 37 | 44 | 52 | 59 | 67 |
| 1.4 | 0.3365 | 3.436  | 3.507  | 3.577  | 3.646  | 3.716  | 3.784  | 3.853  | 3.920  | 3.988  | 7  | 14 | 21 | 28 | 35 | 41 | 48 | 55 | 62 |
| 1.5 | 0.4055 | 4.121  | 4.187  | 4.253  | 4.318  | 4.383  | 4.447  | 4.511  | 4.574  | 4.637  | 6  | 13 | 19 | 26 | 32 | 39 | 45 | 52 | 58 |
| 1.6 | 0.4700 | 4.762  | 4.824  | 4.886  | 4.947  | 5.008  | 5.068  | 5.128  | 5.188  | 5.247  | 6  | 12 | 18 | 24 | 30 | 36 | 42 | 48 | 55 |
| 1.7 | 0.5306 | 5.365  | 5.423  | 5.481  | 5.539  | 5.596  | 5.653  | 5.710  | 5.766  | 5.822  | 6  | 11 | 17 | 23 | 29 | 34 | 40 | 46 | 51 |
| 1.8 | 0.5878 | 5.933  | 5.988  | 6.043  | 6.098  | 6.152  | 6.206  | 6.259  | 6.313  | 6.366  | 5  | 11 | 16 | 22 | 27 | 32 | 38 | 43 | 49 |
| 1.9 | 0.6419 | 6.471  | 6.523  | 6.575  | 6.627  | 6.678  | 6.729  | 6.780  | 6.831  | 6.881  | 5  | 10 | 15 | 20 | 26 | 31 | 36 | 41 | 46 |
| 2.0 | 0.6931 | 6.981  | 7.031  | 7.080  | 7.129  | 7.178  | 7.227  | 7.275  | 7.324  | 7.372  | 5  | 10 | 15 | 20 | 24 | 29 | 34 | 39 | 44 |
| 2.1 | 0.7419 | 7.467  | 7.514  | 7.561  | 7.608  | 7.655  | 7.701  | 7.747  | 7.793  | 7.839  | 5  | 9  | 14 | 19 | 23 | 28 | 33 | 37 | 42 |
| 2.2 | 0.7885 | 7.930  | 7.975  | 8.020  | 8.065  | 8.109  | 8.154  | 8.198  | 8.242  | 8.286  | 4  | 9  | 13 | 18 | 22 | 27 | 31 | 36 | 40 |
| 2.3 | 0.8329 | 8.372  | 8.416  | 8.459  | 8.502  | 8.544  | 8.587  | 8.629  | 8.671  | 8.713  | 4  | 9  | 13 | 17 | 21 | 26 | 30 | 34 | 38 |
| 2.4 | 0.8755 | 8.796  | 8.838  | 8.879  | 8.920  | 8.961  | 9.002  | 9.042  | 9.083  | 9.123  | 4  | 8  | 12 | 16 | 20 | 24 | 29 | 33 | 37 |
| 2.5 | 0.9163 | 9.203  | 9.243  | 9.282  | 9.322  | 9.361  | 9.400  | 9.439  | 9.478  | 9.517  | 4  | 8  | 12 | 16 | 20 | 24 | 27 | 31 | 35 |
| 2.6 | 0.9555 | 9.594  | 9.632  | 9.670  | 9.708  | 9.746  | 9.783  | 9.821  | 9.858  | 9.895  | 4  | 8  | 11 | 15 | 19 | 23 | 26 | 30 | 34 |
| 2.7 | 0.9933 | 9.969  | 10.006 | 10.043 | 10.080 | 10.116 | 10.152 | 10.188 | 10.225 | 10.260 | 4  | 7  | 11 | 15 | 18 | 22 | 25 | 29 | 33 |
| 2.8 | 1.0296 | 10.332 | 10.367 | 10.403 | 10.438 | 10.473 | 10.508 | 10.543 | 10.578 | 10.613 | 4  | 7  | 11 | 14 | 18 | 21 | 25 | 28 | 32 |
| 2.9 | 1.0647 | 10.682 | 10.716 | 10.750 | 10.784 | 10.818 | 10.852 | 10.886 | 10.919 | 10.953 | 3  | 7  | 10 | 14 | 17 | 20 | 24 | 27 | 31 |
| 3.0 | 1.0986 | 10.19  | 10.53  | 10.86  | 11.19  | 11.51  | 11.84  | 12.17  | 12.49  | 12.82  | 3  | 7  | 10 | 13 | 16 | 20 | 23 | 26 | 30 |
| 3.1 | 1.1314 | 13.46  | 13.78  | 14.10  | 14.42  | 14.74  | 15.06  | 15.37  | 15.69  | 16.00  | 3  | 6  | 10 | 13 | 16 | 19 | 22 | 25 | 29 |
| 3.2 | 1.1632 | 16.63  | 16.94  | 17.25  | 17.56  | 17.87  | 18.17  | 18.48  | 18.78  | 19.09  | 3  | 6  | 9  | 12 | 15 | 18 | 21 | 25 | 28 |
| 3.3 | 1.1939 | 19.69  | 20.00  | 20.30  | 20.60  | 20.90  | 21.19  | 21.49  | 21.79  | 22.08  | 3  | 6  | 9  | 12 | 15 | 18 | 21 | 24 | 27 |
| 3.4 | 1.2238 | 22.67  | 22.96  | 23.26  | 23.55  | 23.84  | 24.13  | 24.42  | 24.70  | 24.99  | 3  | 6  | 9  | 12 | 15 | 17 | 20 | 23 | 26 |
| 3.5 | 1.2528 | 25.56  | 25.85  | 26.13  | 26.41  | 26.69  | 26.98  | 27.26  | 27.54  | 27.82  | 3  | 6  | 8  | 11 | 14 | 17 | 20 | 22 | 25 |
| 3.6 | 1.2809 | 28.37  | 28.65  | 28.92  | 29.20  | 29.47  | 29.75  | 30.02  | 30.29  | 30.56  | 3  | 5  | 8  | 11 | 14 | 16 | 19 | 22 | 25 |
| 3.7 | 1.3083 | 31.10  | 31.37  | 31.64  | 31.91  | 32.18  | 32.44  | 32.71  | 32.97  | 33.24  | 3  | 5  | 8  | 11 | 13 | 16 | 19 | 21 | 24 |
| 3.8 | 1.3350 | 33.76  | 34.03  | 34.29  | 34.55  | 34.81  | 35.07  | 35.33  | 35.58  | 35.84  | 3  | 5  | 8  | 10 | 13 | 16 | 18 | 21 | 23 |
| 3.9 | 1.3610 | 36.35  | 36.61  | 36.86  | 37.12  | 37.37  | 37.62  | 37.88  | 38.13  | 38.38  | 3  | 5  | 8  | 10 | 13 | 15 | 18 | 20 | 23 |
| 4.0 | 1.3863 | 38.88  | 39.13  | 39.38  | 39.62  | 39.87  | 40.12  | 40.36  | 40.61  | 40.85  | 2  | 5  | 7  | 10 | 12 | 15 | 17 | 20 | 22 |
| 4.1 | 1.4110 | 41.34  | 41.59  | 41.83  | 42.07  | 42.31  | 42.55  | 42.79  | 43.03  | 43.27  | 2  | 5  | 7  | 10 | 12 | 14 | 17 | 19 | 22 |
| 4.2 | 1.4351 | 43.75  | 43.98  | 44.22  | 44.46  | 44.69  | 44.93  | 45.16  | 45.40  | 45.63  | 2  | 5  | 7  | 9  | 12 | 14 | 16 | 19 | 21 |
| 4.3 | 1.4586 | 46.09  | 46.33  | 46.56  | 46.79  | 47.02  | 47.25  | 47.48  | 47.70  | 47.93  | 2  | 5  | 7  | 9  | 12 | 14 | 16 | 18 | 21 |
| 4.4 | 1.4816 | 48.39  | 48.61  | 48.84  | 49.07  | 49.29  | 49.51  | 49.74  | 49.96  | 50.19  | 2  | 5  | 7  | 9  | 11 | 14 | 16 | 18 | 20 |
| 4.5 | 1.5041 | 50.63  | 50.85  | 51.07  | 51.29  | 51.51  | 51.73  | 51.95  | 52.17  | 52.39  | 2  | 4  | 7  | 9  | 11 | 13 | 15 | 18 | 20 |
| 4.6 | 1.5261 | 52.82  | 53.04  | 53.26  | 53.47  | 53.69  | 53.90  | 54.12  | 54.33  | 54.54  | 2  | 4  | 6  | 9  | 11 | 13 | 15 | 17 | 19 |
| 4.7 | 1.5476 | 54.97  | 55.18  | 55.39  | 55.60  | 55.81  | 56.02  | 56.23  | 56.44  | 56.65  | 2  | 4  | 6  | 8  | 11 | 13 | 15 | 17 | 19 |
| 4.8 | 1.5686 | 57.07  | 57.28  | 57.48  | 57.69  | 57.90  | 58.10  | 58.31  | 58.51  | 58.72  | 2  | 4  | 6  | 8  | 10 | 12 | 14 | 16 | 19 |
| 4.9 | 1.5892 | 59.13  | 59.33  | 59.53  | 59.74  | 59.94  | 60.14  | 60.34  | 60.54  | 60.74  | 2  | 4  | 6  | 8  | 10 | 12 | 14 | 16 | 18 |
| 5.0 | 1.6094 | 61.14  | 61.34  | 61.54  | 61.74  | 61.94  | 62.14  | 62.33  | 62.53  | 62.73  | 2  | 4  | 6  | 8  | 10 | 12 | 14 | 16 | 18 |
| 5.1 | 1.6292 | 63.12  | 63.32  | 63.51  | 63.71  | 63.90  | 64.09  | 64.29  | 64.48  | 64.67  | 2  | 4  | 6  | 8  | 10 | 12 | 14 | 16 | 18 |
| 5.2 | 1.6487 | 65.06  | 65.25  | 65.44  | 65.63  | 65.82  | 66.01  | 66.20  | 66.39  | 66.58  | 2  | 4  | 6  | 8  | 10 | 11 | 13 | 15 | 17 |
| 5.3 | 1.6677 | 66.96  | 67.15  | 67.34  | 67.52  | 67.71  | 67.90  | 68.08  | 68.27  | 68.45  | 2  | 4  | 6  | 7  | 9  | 11 | 13 | 15 | 17 |
| 5.4 | 1.6864 | 68.82  | 69.01  | 69.19  | 69.38  | 69.56  | 69.74  | 69.93  | 70.11  | 70.29  | 2  | 4  | 5  | 7  | 9  | 11 | 13 | 15 | 16 |

TABLE OF NEPERIAN LOGARITHMS OF  $10^n$ 

| n             | 1      | 2      | 3      | 4      | 5       | 6       | 7       | 8       | 9       |
|---------------|--------|--------|--------|--------|---------|---------|---------|---------|---------|
| $\log_e 10^n$ | 2.3026 | 4.6052 | 6.9078 | 9.2103 | 11.5129 | 13.8155 | 16.1181 | 18.4207 | 20.7233 |

|     | 0      | 1    | 2    | 3    | 4    | 5    | 6    | 7    | 8    | 9    | 1 2 3 | 4 5 6  | 7 8 9    |
|-----|--------|------|------|------|------|------|------|------|------|------|-------|--------|----------|
| 5.5 | 1.7047 | 7066 | 7084 | 7102 | 7120 | 7138 | 7156 | 7174 | 7192 | 7210 | 2 4 5 | 7 9 11 | 13 14 16 |
| 5.6 | 1.7228 | 7246 | 7263 | 7281 | 7299 | 7317 | 7334 | 7352 | 7370 | 7387 | 2 4 5 | 7 9 11 | 12 14 16 |
| 5.7 | 1.7405 | 7422 | 7440 | 7457 | 7475 | 7492 | 7509 | 7527 | 7544 | 7561 | 2 3 5 | 7 9 10 | 12 14 16 |
| 5.8 | 1.7579 | 7596 | 7613 | 7630 | 7647 | 7664 | 7681 | 7699 | 7716 | 7733 | 2 3 5 | 7 9 10 | 12 14 15 |
| 5.9 | 1.7750 | 7766 | 7783 | 7800 | 7817 | 7834 | 7851 | 7867 | 7884 | 7901 | 2 3 5 | 7 8 10 | 12 13 15 |
| 6.0 | 1.7918 | 7934 | 7951 | 7967 | 7984 | 8001 | 8017 | 8034 | 8050 | 8066 | 2 3 5 | 7 8 10 | 12 13 15 |
| 6.1 | 1.8083 | 8099 | 8116 | 8132 | 8148 | 8165 | 8181 | 8197 | 8213 | 8229 | 2 3 5 | 6 8 10 | 11 13 15 |
| 6.2 | 1.8245 | 8262 | 8278 | 8294 | 8310 | 8326 | 8342 | 8358 | 8374 | 8390 | 2 3 5 | 6 8 10 | 11 13 14 |
| 6.3 | 1.8405 | 8421 | 8437 | 8453 | 8469 | 8485 | 8500 | 8516 | 8532 | 8547 | 2 3 5 | 6 8 9  | 11 13 14 |
| 6.4 | 1.8563 | 8579 | 8594 | 8610 | 8625 | 8641 | 8656 | 8672 | 8687 | 8703 | 2 3 5 | 6 8 9  | 11 12 14 |
| 6.5 | 1.8718 | 8733 | 8749 | 8764 | 8779 | 8795 | 8810 | 8825 | 8840 | 8856 | 2 3 5 | 6 8 9  | 11 12 14 |
| 6.6 | 1.8871 | 8886 | 8901 | 8916 | 8931 | 8946 | 8961 | 8976 | 8991 | 9006 | 2 3 5 | 6 8 9  | 11 12 14 |
| 6.7 | 1.9021 | 9036 | 9051 | 9066 | 9081 | 9095 | 9110 | 9125 | 9140 | 9155 | 1 3 4 | 6 7 9  | 10 12 13 |
| 6.8 | 1.9169 | 9184 | 9199 | 9213 | 9228 | 9242 | 9257 | 9272 | 9286 | 9301 | 1 3 4 | 6 7 9  | 10 12 13 |
| 6.9 | 1.9315 | 9330 | 9344 | 9359 | 9373 | 9387 | 9402 | 9416 | 9430 | 9445 | 1 3 4 | 6 7 9  | 10 12 13 |
| 7.0 | 1.9459 | 9473 | 9488 | 9502 | 9516 | 9530 | 9544 | 9559 | 9573 | 9587 | 1 3 4 | 6 7 9  | 10 11 13 |
| 7.1 | 1.9601 | 9615 | 9629 | 9643 | 9657 | 9671 | 9685 | 9699 | 9713 | 9727 | 1 3 4 | 6 7 8  | 10 11 13 |
| 7.2 | 1.9741 | 9755 | 9769 | 9782 | 9796 | 9810 | 9824 | 9838 | 9851 | 9865 | 1 3 4 | 6 7 8  | 10 11 12 |
| 7.3 | 1.9879 | 9892 | 9906 | 9920 | 9933 | 9947 | 9961 | 9974 | 9988 | 0001 | 1 3 4 | 5 7 8  | 10 11 12 |
| 7.4 | 2.0015 | 0028 | 0042 | 0055 | 0069 | 0082 | 0096 | 0109 | 0122 | 0136 | 1 3 4 | 5 7 8  | 9 11 12  |
| 7.5 | 2.0149 | 0162 | 0176 | 0189 | 0202 | 0215 | 0229 | 0242 | 0255 | 0268 | 1 3 4 | 5 7 8  | 9 11 12  |
| 7.6 | 2.0281 | 0295 | 0308 | 0321 | 0334 | 0347 | 0360 | 0373 | 0386 | 0399 | 1 3 4 | 5 7 8  | 9 10 12  |
| 7.7 | 2.0412 | 0425 | 0438 | 0451 | 0464 | 0477 | 0490 | 0503 | 0516 | 0528 | 1 3 4 | 5 6 8  | 9 10 12  |
| 7.8 | 2.0541 | 0554 | 0567 | 0580 | 0592 | 0605 | 0618 | 0631 | 0643 | 0656 | 1 3 4 | 5 6 8  | 9 10 12  |
| 7.9 | 2.0669 | 0681 | 0694 | 0707 | 0719 | 0732 | 0744 | 0757 | 0769 | 0782 | 1 3 4 | 5 6 8  | 9 10 11  |
| 8.0 | 2.0794 | 0807 | 0819 | 0832 | 0844 | 0857 | 0869 | 0882 | 0894 | 0906 | 1 3 4 | 5 6 8  | 9 10 11  |
| 8.1 | 2.0919 | 0931 | 0943 | 0956 | 0968 | 0980 | 0992 | 1005 | 1017 | 1029 | 1 2 4 | 5 6 7  | 9 10 11  |
| 8.2 | 2.1041 | 1054 | 1066 | 1078 | 1090 | 1102 | 1114 | 1126 | 1138 | 1150 | 1 2 4 | 5 6 7  | 9 10 11  |
| 8.3 | 2.1163 | 1175 | 1187 | 1199 | 1211 | 1223 | 1235 | 1247 | 1258 | 1270 | 1 2 4 | 5 6 7  | 8 10 11  |
| 8.4 | 2.1282 | 1294 | 1306 | 1318 | 1330 | 1342 | 1353 | 1365 | 1377 | 1389 | 1 2 4 | 5 6 7  | 8 10 11  |
| 8.5 | 2.1401 | 1412 | 1424 | 1436 | 1448 | 1459 | 1471 | 1483 | 1494 | 1506 | 1 2 4 | 5 6 7  | 8 9 11   |
| 8.6 | 2.1518 | 1529 | 1541 | 1552 | 1564 | 1576 | 1587 | 1599 | 1610 | 1622 | 1 2 3 | 5 6 7  | 8 9 10   |
| 8.7 | 2.1633 | 1645 | 1656 | 1668 | 1679 | 1691 | 1702 | 1713 | 1725 | 1736 | 1 2 3 | 5 6 7  | 8 9 10   |
| 8.8 | 2.1748 | 1759 | 1770 | 1782 | 1793 | 1804 | 1815 | 1827 | 1838 | 1849 | 1 2 3 | 5 6 7  | 8 9 10   |
| 8.9 | 2.1861 | 1872 | 1883 | 1894 | 1905 | 1917 | 1928 | 1939 | 1950 | 1961 | 1 2 3 | 4 6 7  | 8 9 10   |
| 9.0 | 2.1972 | 1983 | 1994 | 2006 | 2017 | 2028 | 2039 | 2050 | 2061 | 2072 | 1 2 3 | 4 6 7  | 8 9 10   |
| 9.1 | 2.2083 | 2094 | 2105 | 2116 | 2127 | 2138 | 2148 | 2159 | 2170 | 2181 | 1 2 3 | 4 5 7  | 8 9 10   |
| 9.2 | 2.2192 | 2203 | 2214 | 2225 | 2235 | 2246 | 2257 | 2268 | 2279 | 2289 | 1 2 3 | 4 5 6  | 8 9 10   |
| 9.3 | 2.2300 | 2311 | 2322 | 2332 | 2343 | 2354 | 2364 | 2375 | 2386 | 2396 | 1 2 3 | 4 5 6  | 7 9 10   |
| 9.4 | 2.2407 | 2418 | 2428 | 2439 | 2450 | 2460 | 2471 | 2481 | 2492 | 2502 | 1 2 3 | 4 5 6  | 7 8 10   |
| 9.5 | 2.2513 | 2523 | 2534 | 2544 | 2555 | 2565 | 2576 | 2586 | 2597 | 2607 | 1 2 3 | 4 5 6  | 7 8 9    |
| 9.6 | 2.2618 | 2628 | 2638 | 2649 | 2659 | 2670 | 2680 | 2690 | 2701 | 2711 | 1 2 3 | 4 5 6  | 7 8 9    |
| 9.7 | 2.2721 | 2732 | 2742 | 2752 | 2762 | 2773 | 2783 | 2793 | 2803 | 2814 | 1 2 3 | 4 5 6  | 7 8 9    |
| 9.8 | 2.2824 | 2834 | 2844 | 2854 | 2865 | 2875 | 2885 | 2895 | 2905 | 2915 | 1 2 3 | 4 5 6  | 7 8 9    |
| 9.9 | 2.2925 | 2935 | 2946 | 2956 | 2966 | 2976 | 2986 | 2996 | 3006 | 3016 | 1 2 3 | 4 5 6  | 7 8 9    |

TABLE OF NEPERIAN LOGARITHMS OF  $10^{-n}$ .

| $n$              | 1              | 2              | 3              | 4               | 5               | 6               | 7               | 8               | 9               |
|------------------|----------------|----------------|----------------|-----------------|-----------------|-----------------|-----------------|-----------------|-----------------|
| $\log_e 10^{-n}$ | $\bar{3}.6974$ | $\bar{5}.3948$ | $\bar{7}.0922$ | $\bar{10}.7897$ | $\bar{12}.4871$ | $\bar{14}.1845$ | $\bar{17}.8819$ | $\bar{19}.5793$ | $\bar{21}.2767$ |



TABLE OF POWERS OF  $\epsilon$ ;  $-\epsilon$  BEING THE BASE OF THE HYPERBOLIC LOGARITHMS.

|                   |         |                    |                        |                             |         |                              |                        |                             |         |                              |                       |
|-------------------|---------|--------------------|------------------------|-----------------------------|---------|------------------------------|------------------------|-----------------------------|---------|------------------------------|-----------------------|
| $\epsilon$        | 2.7183  | $\epsilon^{-1}$    | 0.3679                 | $\epsilon^{\frac{1}{2}}$    | 1.6487  | $\epsilon^{-\frac{1}{2}}$    | 0.6065                 | $\epsilon^{\frac{1}{3}}$    | 1.6487  | $\epsilon^{-\frac{1}{3}}$    | 0.6065                |
| $\epsilon^2$      | 7.3891  | $\epsilon^{-2}$    | 0.1353                 | $\epsilon^{\frac{2}{3}}$    | 4.4816  | $\epsilon^{-\frac{2}{3}}$    | 0.2231                 | $\epsilon^{\frac{2}{3}}$    | 1.3956  | $\epsilon^{-\frac{2}{3}}$    | 0.7165                |
| $\epsilon^3$      | 20.086  | $\epsilon^{-3}$    | 0.04979                | $\epsilon^{\frac{5}{6}}$    | 12.182  | $\epsilon^{-\frac{5}{6}}$    | 0.0821                 | $\epsilon^{\frac{1}{4}}$    | 1.2840  | $\epsilon^{-\frac{1}{4}}$    | 0.7788                |
| $\epsilon^4$      | 54.598  | $\epsilon^{-4}$    | 0.01832                | $\epsilon^{\frac{7}{6}}$    | 33.114  | $\epsilon^{-\frac{7}{6}}$    | 0.0302                 | $\epsilon^{\frac{1}{5}}$    | 1.2214  | $\epsilon^{-\frac{1}{5}}$    | 0.8187                |
| $\epsilon^5$      | 148.41  | $\epsilon^{-5}$    | 0.006738               | $\epsilon^{\frac{4}{3}}$    | 1.2840  | $\epsilon^{-\frac{4}{3}}$    | 0.7788                 | $\epsilon^{\frac{1}{6}}$    | 1.1814  | $\epsilon^{-\frac{1}{6}}$    | 0.8465                |
| $\epsilon^6$      | 403.43  | $\epsilon^{-6}$    | 0.002479               | $\epsilon^{\frac{3}{2}}$    | 1.1331  | $\epsilon^{-\frac{3}{2}}$    | 0.8825                 | $\epsilon^{\frac{1}{7}}$    | 1.1536  | $\epsilon^{-\frac{1}{7}}$    | 0.8669                |
| $\epsilon^7$      | 1096.6  | $\epsilon^{-7}$    | 0.0009119              | $\epsilon^{\frac{11}{6}}$   | 1.0645  | $\epsilon^{-\frac{11}{6}}$   | 0.9394                 | $\epsilon^{\frac{1}{8}}$    | 1.1331  | $\epsilon^{-\frac{1}{8}}$    | 0.8825                |
| $\epsilon^8$      | 2981.0  | $\epsilon^{-8}$    | 0.0003355              | $\epsilon^{\frac{13}{6}}$   | 1.0317  | $\epsilon^{-\frac{13}{6}}$   | 0.9692                 | $\epsilon^{\frac{1}{9}}$    | 1.1175  | $\epsilon^{-\frac{1}{9}}$    | 0.8948                |
| $\epsilon^9$      | 8103.1  | $\epsilon^{-9}$    | 0.0001234              |                             |         |                              |                        | $\epsilon^{\frac{1}{10}}$   | 1.1052  | $\epsilon^{-\frac{1}{10}}$   | 0.9048                |
| $\epsilon^{10}$   | 22026.  | $\epsilon^{-10}$   | 0.0000454              |                             |         |                              |                        |                             |         |                              |                       |
| $\epsilon^{\pi}$  | 23.1407 | $\epsilon^{-\pi}$  | $43214 \times 10^{-6}$ | $\epsilon^{\frac{\pi}{2}}$  | 4.8105  | $\epsilon^{-\frac{\pi}{2}}$  | $20788 \times 10^{-6}$ | $\epsilon^{\frac{\pi}{4}}$  | 2.1933  | $\epsilon^{-\frac{\pi}{4}}$  | $4559 \times 10^{-4}$ |
| $\epsilon^{2\pi}$ | 535.491 | $\epsilon^{-2\pi}$ | 1867 $\times$ "        | $\epsilon^{\frac{3\pi}{2}}$ | 111.32  | $\epsilon^{-\frac{3\pi}{2}}$ | $898.33 \times$ "      | $\epsilon^{\frac{3\pi}{4}}$ | 10.557  | $\epsilon^{-\frac{3\pi}{4}}$ | $947.8 \times$ "      |
| $\epsilon^{3\pi}$ | 12391.7 | $\epsilon^{-3\pi}$ | $80.699 \times$ "      | $\epsilon^{\frac{5\pi}{2}}$ | 2576.0  | $\epsilon^{-\frac{5\pi}{2}}$ | $38.820 \times$ "      | $\epsilon^{\frac{5\pi}{4}}$ | 50.754  | $\epsilon^{-\frac{5\pi}{4}}$ | $197.0 \times$ "      |
| $\epsilon^{4\pi}$ | 286752. | $\epsilon^{-4\pi}$ | $3.487 \times$ "       | $\epsilon^{\frac{7\pi}{2}}$ | 59609.6 | $\epsilon^{-\frac{7\pi}{2}}$ | $1.6776 \times$ "      | $\epsilon^{\frac{7\pi}{4}}$ | 244.15  | $\epsilon^{-\frac{7\pi}{4}}$ | $40.96 \times$ "      |
| $\epsilon^{5\pi}$ | 6635627 | $\epsilon^{-5\pi}$ | $.1507 \times$ "       | $\epsilon^{\frac{9\pi}{2}}$ | 1379406 | $\epsilon^{-\frac{9\pi}{2}}$ | $.0725 \times$ "       | $\epsilon^{\frac{9\pi}{4}}$ | 1174.48 | $\epsilon^{-\frac{9\pi}{4}}$ | $8.514 \times$ "      |

# USEFUL FORMULAS AND NUMBERS.

## Binomial Theorem.

$$(1 \pm e)^n = 1 \pm ne + \frac{n \cdot n - 1}{1 \cdot 2} e^2 \pm \frac{n \cdot n - 1 \cdot n - 2}{1 \cdot 2 \cdot 3} e^3 + \&c.$$

Hence, when  $ne$  is so small that its square and higher powers may be neglected,

$$(1 \pm e)^n \doteq 1 \pm ne.$$

## Examples—

$$e = .01; (1 + .01)^2 \doteq 1.02; (1 + .01)^{\frac{1}{2}} \doteq 1.005; (1 + .01)^{-\frac{1}{2}} \doteq .9967.$$

**Barometric Formula.**—Let  $P$  and  $p$  be the atmospheric pressures observed by the barometer at the lower and upper stations respectively; and let  $T$  and  $t$  be the respective atmospheric temperatures on the Fahrenheit scale; then  $H$ , being the difference of levels in feet,

$$H = 60360 \{ \log P - \log p \} \left( 1 + \frac{T + t - 64}{986} \right).$$

**Base of Hyperbolic or Neperian Logarithms,** . . . . .  $e = 2.71828$ .

To convert common into hyperbolic logarithms, multiply by . . . . . 2.30258.

To convert hyperbolic into common logarithms, multiply by . . . . . 0.43429.

Ratio of circumference of circle to diameter, . . . . .  $\pi = 3.14159$ .

Number of degrees in one radian (the unit angle, which is the angle subtended by arc equal to radius),  $57^\circ.2958 = 57^\circ 17' 45'' = 206265''$ .

|  |          | Logarithm.                              |
|--|----------|---|
| $\pi = 3.14159$                            | .        | 0.49715                                 |
| $e = 2.71828$                              | .        | 0.43429                                 |
| Metre in inches, . . . . .                 | 39.37043 | Cubic inch of distilled                 |
| Foot in centimetres, . . . . .             | 30.4797  | water at $4^\circ\text{C}$ , . . . . .  |
| Mile in kilometres, . . . . .              | 1.6093   | Cubic foot of water at                  |
| Gramme in grains, . . . . .                | 15.43235 | $4^\circ\text{C}$ , . . . . .           |
| Pound in grammes, . . . . .                | 453.593  | Cubic inch of mercury                   |
| Kilogramme in pounds, . . . . .            | 2.2046   | at $0^\circ\text{C}$ , . . . . .        |
| British ton in French tons                 |          | Do. do., . . . . .                      |
| of 1000 kilos., . . . . .                  | 1.016    | Litre of dry air at $0^\circ\text{C}$ , |
| Litre in cubic inches, . . . . .           | 61.0253  | 760 <sup>m.m.</sup> pressure, . . . . . |
| Cubic inch in cubic centimetres, . . . . . | 16.3866  | Cubic foot " " . . . . .                |
| Cubic foot in cubic centimetres, . . . . . | 28316.0  | Density of mercury, . . . . .           |

|   |  |
|---|--|
| 1 centim. gramme . . . . .  | 981 ergs.                              |
| 1 metre kilogramme . . . . .  | $9 \cdot 81 \times 10^7$ .             |
| 1 ft. lb. . . . .   | $13 \cdot 56 \times 10^6$ ergs.        |
| 1 ft. poundal (independent of <i>g</i> .) . . . . .   | 421390 ergs.                           |
| 1 joule (1 watt for 1 second) . . . . .   | $10^7$ ergs.                           |
| 1 horse power. . . . .  | $7 \cdot 46 \times 10^9$ ergs per sec. |
| 1 watt (rate of working of 1 volt through 1 ohm, or of 1 volt carrying 1 ampere)<br>= $10^7$ ergs per second. |  |

|  |  |
|--|--|
| Earth's mean radius, $6 \cdot 371 \times 10^8$ centims   | Mass of moon, . $1/81 \cdot 5$ of earth's mass                         |
| Earth's mean radius<br>(approx.), . $21 \times 10^6$ feet.                                     | Distance of moon<br>from earth, . $3 \cdot 8 \times 10^{10}$ centims.  |
| Mass of earth, assuming $5 \cdot 67$ as<br>mean density, . $6 \cdot 14 \times 10^{27}$ grammes | Sun's radius, . $697 \times 10^8$ centims.                             |
| Earth's mass (approximately), . $13 \cdot 5 \times 10^{24}$ lbs. =<br>$6 \times 10^{21}$ tons. | Mass of sun, . $324000$ earth's mass.                                  |
|  | Distance of sun<br>from earth, . $1 \cdot 498 \times 10^{13}$ centims. |
|  | Distance of sun<br>from earth, . $93 \cdot 1 \times 10^6$ miles.       |

|   |   |
|---|---|
| Seconds pendulum at<br>Greenwich, . . $39 \cdot 139$ inches =<br>$99 \cdot 414$ centims.  | Mass in grammes which<br>concentrated at a<br>point 1 centimetre<br>distant from a point at<br>which another equal<br>mass is concentrated<br>would attract it with a<br>force of 1 dyne, $3928$ grammes. |
| Gravity of 1 pound<br>at Greenwich, . $32 \cdot 191$ poundals.  | Same where the foot,<br>pound, and poundal<br>are units of length,<br>mass, and force, $31,075$ lbs.  |
| Gravity of 1 pound<br>mass in lat. $55^\circ 35'$<br>(approximately that<br>of Edinburgh or<br>Glasgow), . $32 \cdot 2$ poundals. |   |
| Gravity of 1 gramme<br>in same latitude, . $981 \cdot 424$ dynes.   |   |

**Height of Homogeneous atmosphere** at Greenwich at  $0^\circ\text{C}$ ,  $26,210$  ft. =  
 $7 \cdot 988 \times 10^5$  centims.

**Newtonian velocity of sound** in air at  $0^\circ\text{C}$ , . .  $918 \cdot 5$  feet per second,  
=  $27996$  centims. per second.

**True velocity** at  $t^\circ\text{C}$  =  $33240 \sqrt{1 + \cdot 00366 t}$  centims. per second.

**Joule's Equivalent.**  $777 \cdot 2$  Greenwich foot-pounds of work will raise  
1 lb. pure water from  $60^\circ$  to  $61^\circ$  Fahrenheit.

This is equivalent to  $1399$  ft.-lbs. per pound degree centigrade,—or  
 $41 \cdot 84 \times 10^6$  ergs per gramme degree centigrade,—or  $42600$  centi-  
metre-grammes per gramme degree.

**Latent heat of water**,  $79 \cdot 25$ . Latent heat of steam at  $100^\circ$ ,  $537$

**Specific heat of air** pressure constant,  $0 \cdot 237$  ;  
sp. heat of air pres. const. =  $1 \cdot 4$ .  
sp. heat of air vol. const.

**1 litre of hydrogen** at  $0^\circ\text{C}$  and  $760$  mm. pressure weighs  $0 \cdot 0896$  gm.

**Density of hydrogen** compared with air =  $0 \cdot 0693 = \frac{1}{14 \cdot 43}$ .



**Conductivity of heat.** Quantity, in gramme-water-centigrade units ; conducted per second ; per square centimetre of area ; per degree, per centimetre of thickness, of difference of temperature of two sides of plate.

|              |             |
|--------------|-------------|
| Copper,..... | ·996        |
| Iron,.....   | ·15 to ·19  |
| Stone,.....  | ·01 to ·005 |

**Velocity of light in vacuum** =  $3 \cdot 004 \times 10^{10}$  centims. per second.

**Mean wave length**  $5 \cdot 3 \times 10^{-5}$  centim.

**One electromagnetic unit** =  $3 \times 10^{10}$  electrostatic units of electricity

**1 B. A. Unit** = ·9866 Ohm. **1 Ohm** = 1·01358 B. A. Unit.

|   |             |
|---|-------------|
| <b>Resistance of 100 metres of pure annealed round wire, 1 mm. in diameter, at 0°C,</b> |             |
| Copper, . . . . .   | 2·028 ohms. |
| Iron, . . . . .   | 12·34 "     |
| Platinum, . . . . .   | 11·50 "     |
| Platinoid, . . . . .  | 41·17 "     |

|  |             |
|--|-------------|
| <b>Electro-motive force of 1 Daniell's cell,</b> . . . . . | 1·07 volt.  |
| " " <b>1 Grove's cell,</b> . . . . .                       | 1·95 "      |
| " " <b>Standard Clark cell at 15°C,</b> . . . . .          | 1·435 volt. |
| " " " " <b>t°C</b> $1 \cdot 435 [1 - \cdot 00077(t - 15)]$ |             |

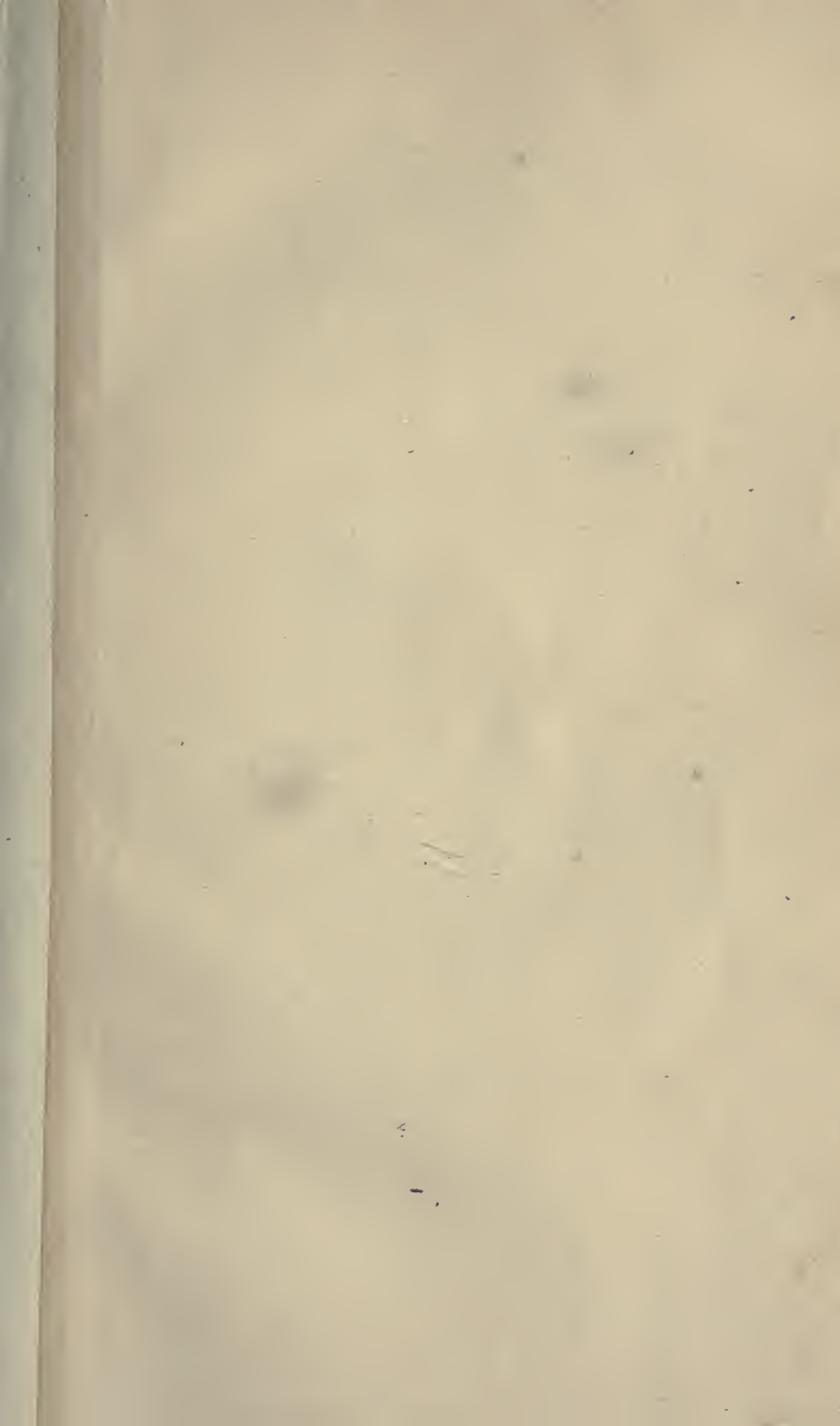
**One volt through one ohm (1 watt) generates per second**  $\frac{1}{4 \cdot 184}$  **of a thermal unit (gramme-water-centigrade).**

#### Electro-Chemical Decomposition.—

| Element.   | Atomic Weight. | Chem. Equivalent. | Electrolytic Decomposition, Grammes per second, per ampere. |
|------------|----------------|-------------------|---|
| Hydrogen,  | 1              | 1                 | ·00001038   |
| Potassium, | 39·03          | 39·03             | ·0004051  |
| Sodium,    | 23·            | 23·               | ·0002387  |
| Silver,    | 107·7          | 107·7             | ·001118   |
| Copper,*   | 63·35          | 31·68             | ·0003290  |
| Zinc,      | 64·88          | 32·44             | ·0003367  |
| Lead,      | 206·4          | 103·2             | ·001071   |
| Oxygen,    | 15·96          | 7·98              | ·00008283   |
| Chlorine,  | 35·37          | 35·37             | ·0003671  |

\* For cathode surface of 50 sq. centims. per ampere, the quantity of copper deposited per ampere per second is ·0 03287 gms. For increments in cathode surface subtract 1·16th p.c. per 50 sq. centims. The numbers given for silver and copper are the results of direct experiment

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